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FM 44-1-2

AIR DEFENSE ARTILLERY

REFERENCE

HANDBOOK

Field Manual
No. 44-1-2

FM 44-1-2

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D.C., 30 June 1978

AIR DEFENSE ARTILLERY
REFERENCE HANDBOOK

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CHAPTER 1 PURPOSE AND SCOPE

1-1 PURPOSE

The purpose of this manual is to provide a ready source of carefully selected material in a convenient format for officers and noncommissioned officers assigned functions and duties concerned with the employment of air defense artillery (ADA) units and weapons.

1-2 SCOPE

Contents

Reference data have been included on a wide variety of subjects pertinent to the functions and duties of personnel serving in the Army ADA specialty. This manual will aid the officer and noncommissioned officer in the following types of duty positions:

- **Commanding, directing, and controlling ADA units.**
- **Staff positions in headquarters and activities requiring ADA expertise.**
- **Airspace management elements of division and higher level.**
- **Instructor positions in ADA specialty in service schools and ROTC.**
- **Members of advisory elements and groups assigned to missions in foreign countries.**
- **Advisory positions in Reserve forces elements.**
- **Combat and leadership positions in special forces units.**
- **Executive and advisory positions requiring knowledge of a variety of air defense subjects.**

Comments

Users are reminded that materiel, organization, and tactics are continually changing. For precise planning, other publications such as Technical Manuals, Tables of Organization and Equipment, and Field Manuals, which provide more detailed information on specific subjects, should be consulted.

Users of this manual are encouraged to submit recommended changes or comments to improve the publication. Comments should be keyed to the specific page and line of text in which the change is recommended. Reasons should be provided for each comment to insure understanding and complete evaluation. Comments should be prepared on DA Form 2028 (Recommended Changes to Publications and Blank Forms) and forwarded direct to:

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The wording in this manual should not be construed to discriminate between the sexes. In order to avoid a repetitious use of the terminology he/she, the terms he, him, and his are intended to include both the masculine and feminine gender. Any exceptions to this will be noted.

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CHAPTER 2 GUN SYSTEMS

2-1 GUN, ANTIAIRCRAFT ARTILLERY, SELF-PROPELLED, TWIN 40-MM, M42A1 (DUSTER)

The M42A1 (fig 2-1) is a full-track armored combat vehicle. It is designed for deployment with the maneuver forces in the forward combat areas as a means for providing defense against low-altitude air attack. The M42A1 is capable of delivering a high rate of fire against ground targets such as enemy personnel, lightly armored vehicles, bunkers, and similar targets. The vehicle is powered by a horizontally opposed 6-cylinder, supercharged, air-cooled engine, which uses a fuel-injection system.

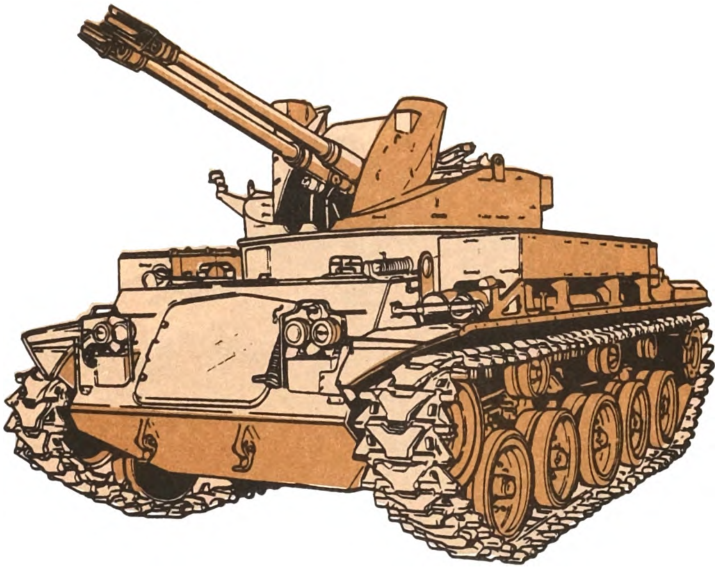

***Figure 2-1.** Gun, Antiaircraft Artillery, Self-propelled Twin 40-mm, M42A1.*

USER NOTE: US Army National Guard ADA automatic weapons units are issued the M42A1. No M42A1 units are in the Active Army.

2-2 GUN, AIR DEFENSE ARTILLERY, SELF-PROPELLED, 20-MM, (VULCAN)

The Vulcan M163 (fig 2-2) is a full-tracked, lightweight, lightly armored gun system designed for deployment in the forward combat area to provide air defense against the low-altitude air threat. The system is capable of delivering a selected rate of fire (1,000 or 3,000 rounds per min) against air and ground targets with burst limits selectable at the high rate of fire of 10-, 30-, 60-, or 100-round bursts. Vulcan can be used against stationary or moving targets such as personnel, trucks, and light armored vehicles. Vulcan is highly mobile, capable of high-speed operation on improved roads, cross-country travel over rough terrain, and amphibious operation on streams and small lakes. The system is air portable by cargo aircraft.

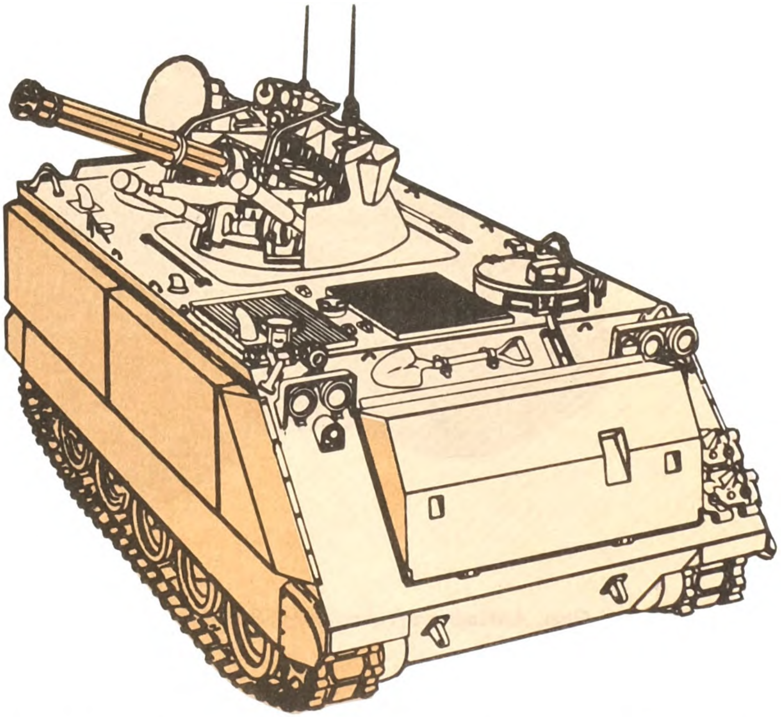

Figure 2-2. Gun, Air Defense Artillery, Self-propelled, 20-mm, Vulcan.

2-3 GUN, AIR DEFENSE ARTILLERY TOWED, 20-MM, M167 (VULCAN)

The Vulcan towed air defense artillery weapon system (fig 2-3), consists of a 6-barrel, 20-mm cannon and a fire control system mounted on a 2-wheel trailer carriage. The system is capable of being towed at high speeds over improved roads, travel over rough terrain, and fording streams to a depth of 30 inches. Towed Vulcan has essentially the same target engagement capability as the SP Vulcan; the cannon (M168) characteristics, fire control system, and modes of operation are the same as SP Vulcan; the primary difference is that the Towed Vulcan uses a linked feed system and is mounted on a trailer. The system is designed to be towed by a 1¼-ton truck M561; however, an adapter permits the system to be towed by the 2½-ton truck M35. The system is air portable by cargo aircraft and helicopter, and can be air dropped.

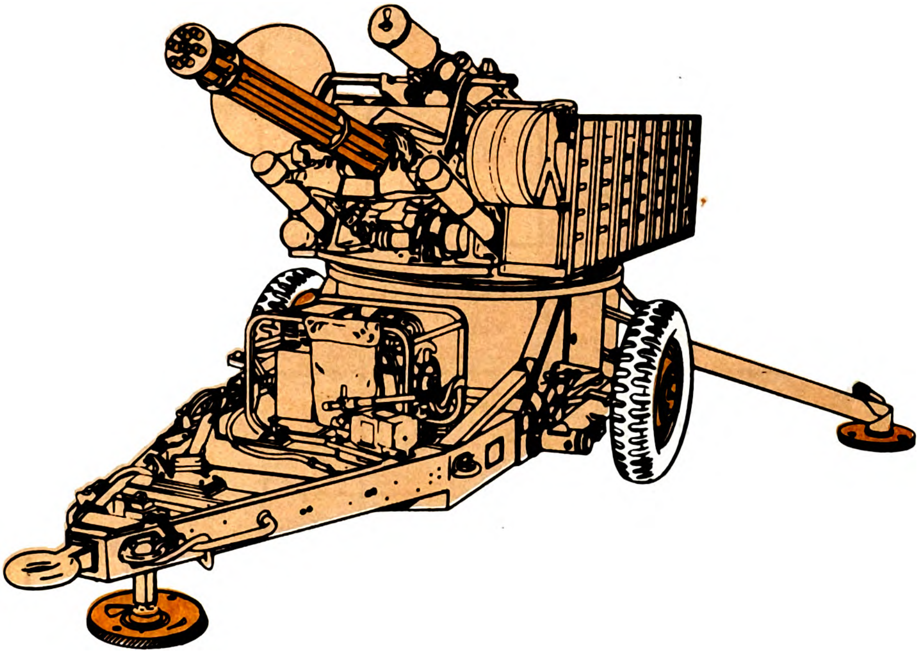

Figure 2-3. Gun, Air Defense Artillery, Towed, 20-mm, M167 (Vulcan).

Table 2-1. Characteristics of the Air Defense Artillery Gun Systems.

SYSTEM CHARACTERISTICS

WEAPON	Weight Combat Loaded	Width Overall	Length Overall	Height Travel Modes	Allowable Speed	Cruising Range (AV)
GUN, M42, M42A1 SP TWIN 40-MM DUSTER	49,500 lb	127 in	251 in	113 in	45 mph	100 Miles
GUN, AIR DEFENSE ARTILLERY, SP 20-MM VULCAN	24,700 lb	113 in	172 in	115 in	40 mph	275 Miles
GUN, AIR DEFENSE ARTILLERY TOWED, 20-MM VULCAN	3,150 lb	79 in	152 in	81 in	45 mph towing speed	N/A

WEAPON CHARACTERISTICS

WEAPON	Range Aerial/Ground (Meters)	Traverse Limits	Elevation Limits	Max Rate of Fire	Rounds on Carriage
GUN, M42, M42A1 SP TWIN 40—MM DUSTER	1650/1850	360°	-5°-to +87°	120 rds per min per tube	432
GUN, AIR DEFENSE ARTILLERY, SP, 20-MM VULCAN	1,200/4,500	360°	-5°-to +80°	3,000 rds/min (10,30, 60,100 rd bursts)	1,800-2,000
GUN, AIR DEFENSE ARTILLERY TOWED, 20-MM VULCAN	1,200/4,500	360°	-5°-to +80°	3,000 rds/min (10,30, 60, 100 rd bursts)	500

MISCELLANEOUS

WEAPON	Crew	Fire Control	No. of Barrels	Barrel Life	Ammunition	References
GUN, M42, M42A1 SP TWIN 40-MM DUSTER	6	Computing sight M38	2	12,000 rds	HEI-T, SD HE-T, SD AP-T	FM 44-2 FM 44-61 FM 44-62 TM 9-7218
GUN, AIR DEFENSE ARTILLERY, SP, 20-MM VULCAN	4	Lead computing sight & range-only radar	6	12,000 rds	HEI-T, SD HEI TP	FM 44-3 FM 44-5 TC 44-5-1 TM 9-2300-257-20 TM 9-2350-300-10 TM 9-2350-300-20/1 TM 9-2350-300-20/2
GUN, AIR DEFENSE ARTILLERY TOWED, 20-MM VULCAN	4	Lead computing sight & range-only radar	6	12,000 rds	HEIT-SD HEI TP	FM 44-3 FM 44-100 TM 9-1005-286-10 TM 9-1005-286-20/1 TM 9-1005-286-20/2

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CHAPTER 3 MISSILE SYSTEMS

3-1 IMPROVED HAWK AIR DEFENSE GUIDED MISSILE SYSTEM

The Improved Hawk (fig 3-1) is a medium-range air defense guided missile system designed to provide air defense coverage against low-to-medium altitude air attack. Improved Hawk is fielded in the towed configuration only. All major components are trailer mounted giving the system a high degree of operational mobility. Improved Hawk uses advanced technology to meet increased threats. Improved Hawk units are deployed with the corps and in direct support of the division. Basically, the system is employed in the battery configuration but can be reconfigured into separate platoons for greater combat flexibility. The system is air portable by cargo aircraft and can be sling-lifted by helicopter.

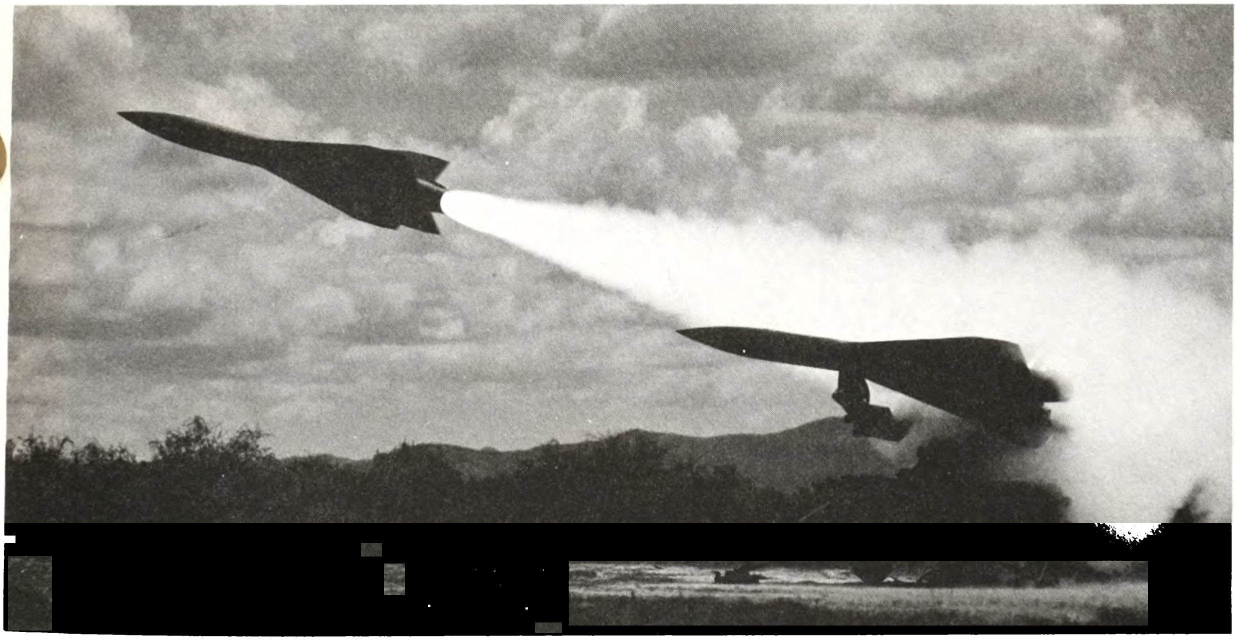

Figure 3-1. Improved Hawk Air Defense Guided Missile System.

3-2 BASIC HAWK AIR DEFENSE GUIDED MISSILE SYSTEM

Basic Hawk is a medium-range surface-to-air, guided missile system designed to provide air defense coverage against low-to-medium altitude air attack. Basic Hawk is fielded in the towed configuration. The battery can engage two separate targets simultaneously. The system is air portable by cargo aircraft and can be sling-lifted by helicopter. Basic Hawk is programed for replacement by the Improved Hawk.

USER NOTE: Illustration of the Basic Hawk system is not shown. Configuration for both the Basic and Improved Hawk systems, with minor exceptions, are similar.

3-3 CHAPARRAL AIR DEFENSE GUIDED MISSILE SYSTEM

The Chaparral weapon system (fig 3-2), is a highly mobile surface-to-air missile system designed to counter the high-speed, low-altitude threat to organizations and critical assets in the forward areas. Chaparral is fielded in the self-propelled configuration only; however, the launching station is a complete, self-contained weapon system and may be separated from the carrier and operated in a ground-emplaced mode. Effective employment of the sytem depends upon visual target detection, tracking and recognition. Chaparral is considered to be a fair weather system capable of operation only during periods of good visibility. The system is air portable by cargo aircraft. The launching station may be sling-lifted by helicopter when separated from the carrier. The system is composed of three major elements: the launching station, carrier, and Chaparral missiles.

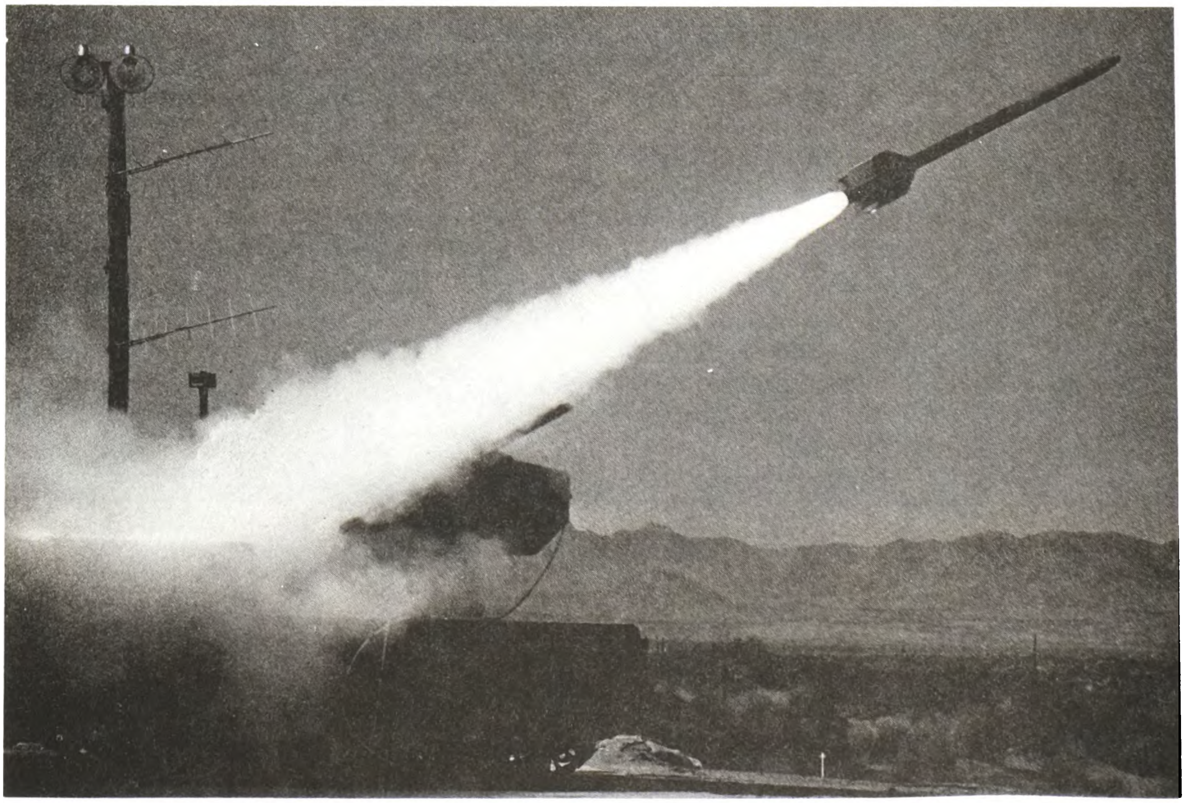

Figure 3-2. Chaparral Air Defense Guided Missile System (M48).

3-4 REDEYE AIR DEFENSE GUIDED MISSILE SYSTEM

Redeye (fig 3-3), is a short-range, man-portable, shoulder fired air defense guided missile system designed to provide combat units with the capability of destroying low-altitude hostile aircraft. Redeye is deployed easily and flexibly throughout the combat area. It moves with the troops providing continuous and responsive air defense.

The Redeye weapon consists of three major components: launcher, missile, and launcher battery coolant unit (fig 3-3). The missile, sealed within the launcher, is not removed in the field except by firing.

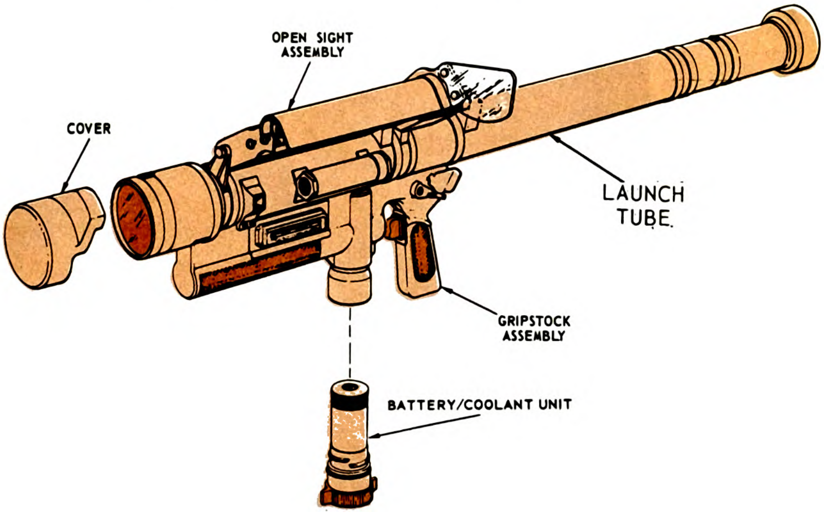

Figure 3-3. Redeye Complete W/Missile, Launcher, and Launcher Battery/Coolant Unit.

3-5 NIKE HERCULES GUIDED MISSILE SYSTEM

Nike Hercules guided missile system (fig 3-4), is an Army long-range, surface-to-air, air defense guided missile system. The system is designed to engage hostile high-performance aircraft operating in the medium-to-high-altitude range. The system is reliable, extremely accurate, and when employed in a nuclear mode, can destroy the multiple target aircraft threat. Modifications to the basic system components have improved engagement capability against smaller, faster, and higher-flying targets in a sophisticated electronic countermeasures environment. The Nike Hercules battery is normally deployed in the semimobile configuration; however, in a static situation, system components may be installed in a permanent or semipermanent emplacement. Nike Hercules guided missile system is emplaced in two areas, the battery control and launching control areas. Illustrations of the system components located in these two areas are shown in figures 3-5 and 3-6. Although Nike Hercules is a surface-to-air system, it has surface-to-surface capability and may be assigned this mission when the situation dictates. The system is air portable by heavy-lift helicopter.

Nike Hercules is an all weather system. It can engage airborne targets at 2,100 miles per hour (approximate), at ranges greater than 75 miles, at altitudes up to 150,000 feet. It possesses a nuclear capability, and a surface-to-surface capability with a range in excess of 75 miles.

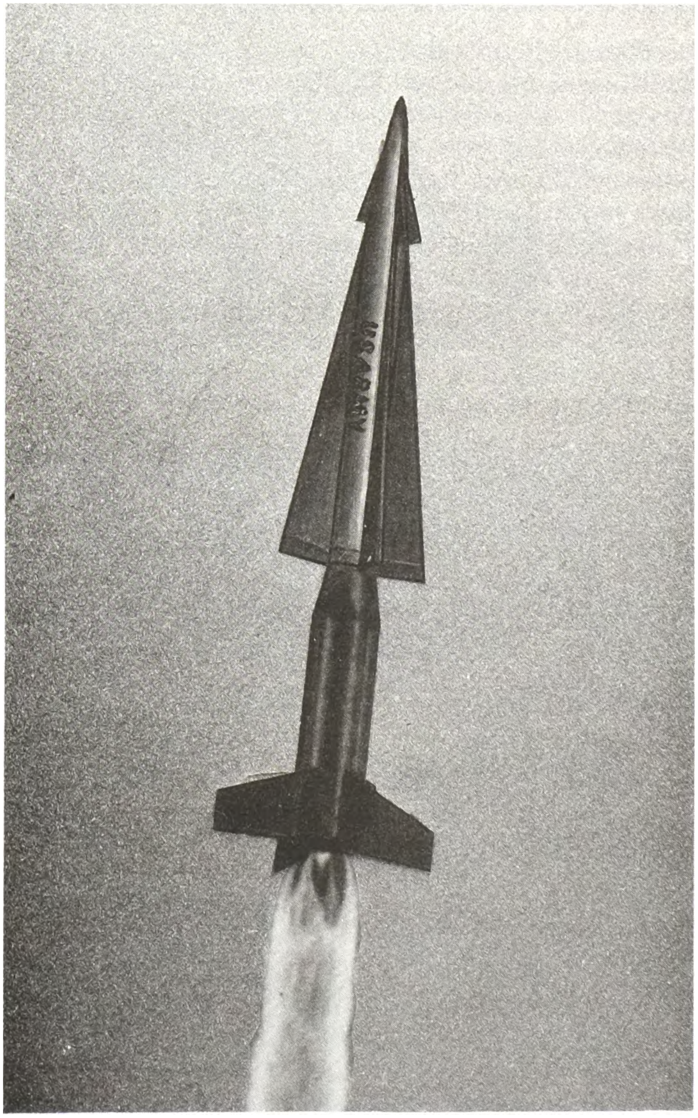

Figure 3-4. Nike Hercules in a Firing Attitude.

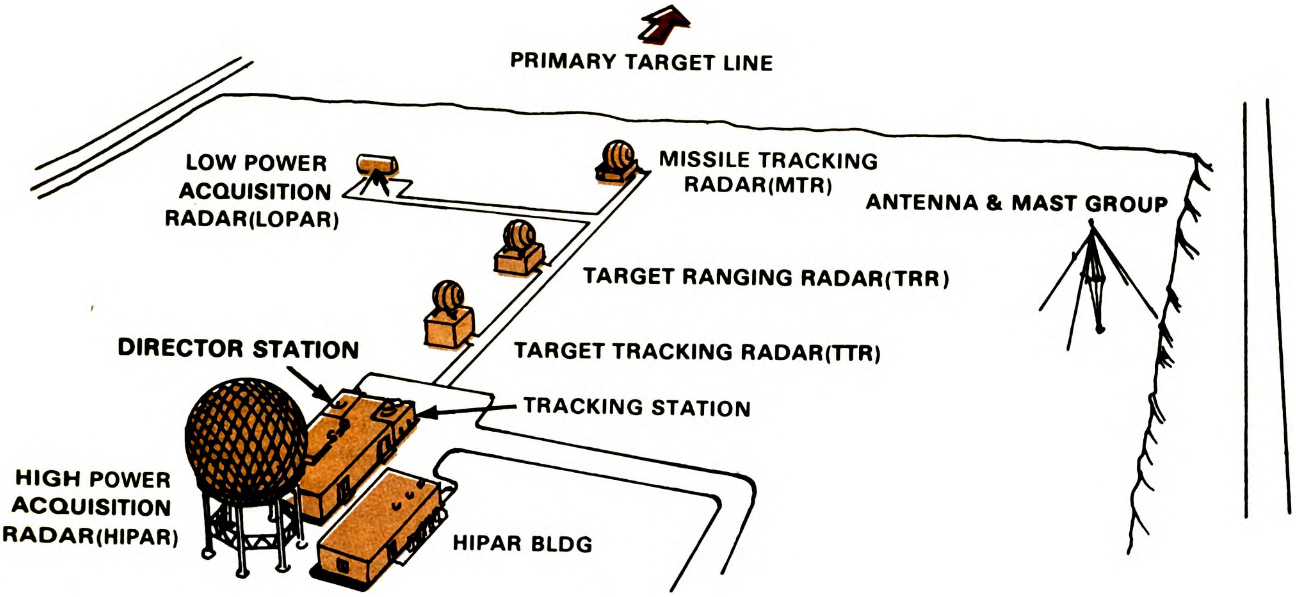
PRIMARY TARGET LINE
LOW POWER ACQUISITION RADAR(LOPAR)
MISSILE TRACKING RADAR(MTR)
ANTENNA & MAST GROUP
TARGET RANGING RADAR(TRR)
DIRECTOR STATION
TARGET TRACKING RADAR(TTR)
TRACKING STATION
HIGH POWER ACQUISITION RADAR(HIPAR)
HIPAR BLDG

Figure 3-5. Battery Control Area (NH).

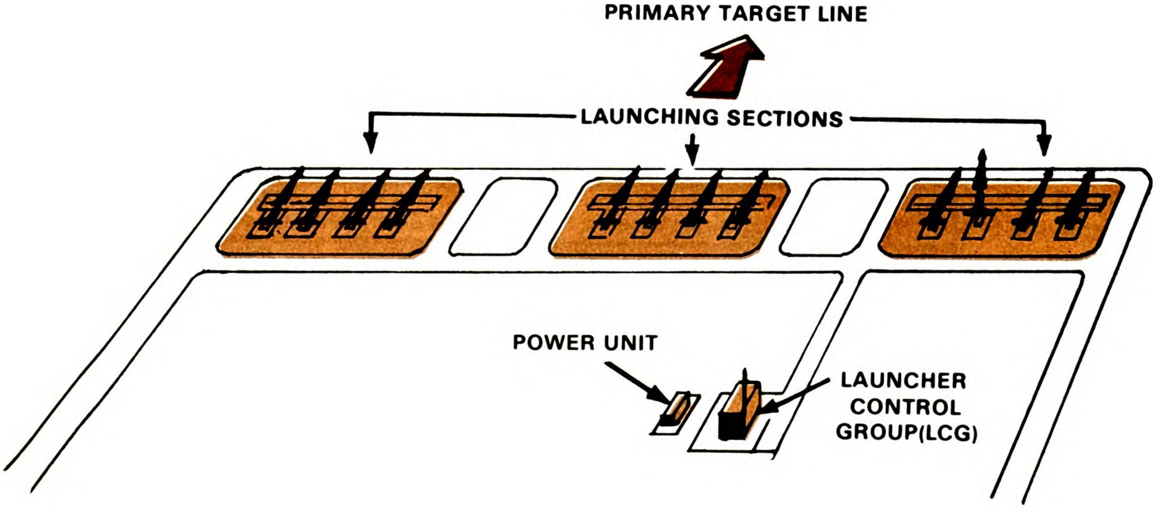

Figure 3-6. Launching Control Area (NH).

Table 3-1. Characteristics of Air Defense Artillery Missile Systems.

MISSILE

SYSTEM	Range	Guidance	Warhead	Motor	Weight
NIKE HERCULES	120Km-160Km	Command	High explosive/ nuclear	Solid Propellant	10,500 lb
IMPROVED HAWK	40Km	Semi-active Homing	HE	Solid propellant	1,401 lb
BASIC HAWK	32Km	Semi-active Homing	HE	Solid propellant	1,290 lb
CHAPARRAL	5Km	Passive infrared homing	HE	Solid propellant	190 lb
REDEYE	3Km	Passive infrared homing;	HE	Solid propellant	28.9 lb

MISCELLANEOUS

SYSTEM	References	Air Transportable	Target
NIKE HERCULES	FM 44-82 FM 44-95	Cargo Aircraft Helicopter	High-to-medium aircraft; priority surface tgts
IMPROVED HAWK	FM 44-90 FM 44-101	Cargo Aircraft Helicopter	Low-to-medium altitude aircraft
BASIC HAWK	FM 44-99	Cargo Aircraft Helicopter	Low-to-medium altitude aircraft
CHAPARRAL	FM 44-3 FM 44-4	Cargo Aircraft Helicopter	Low altitude aircraft
REDEYE	FM 44-23	Cargo Aircraft Helicopter	Low altitude aircraft

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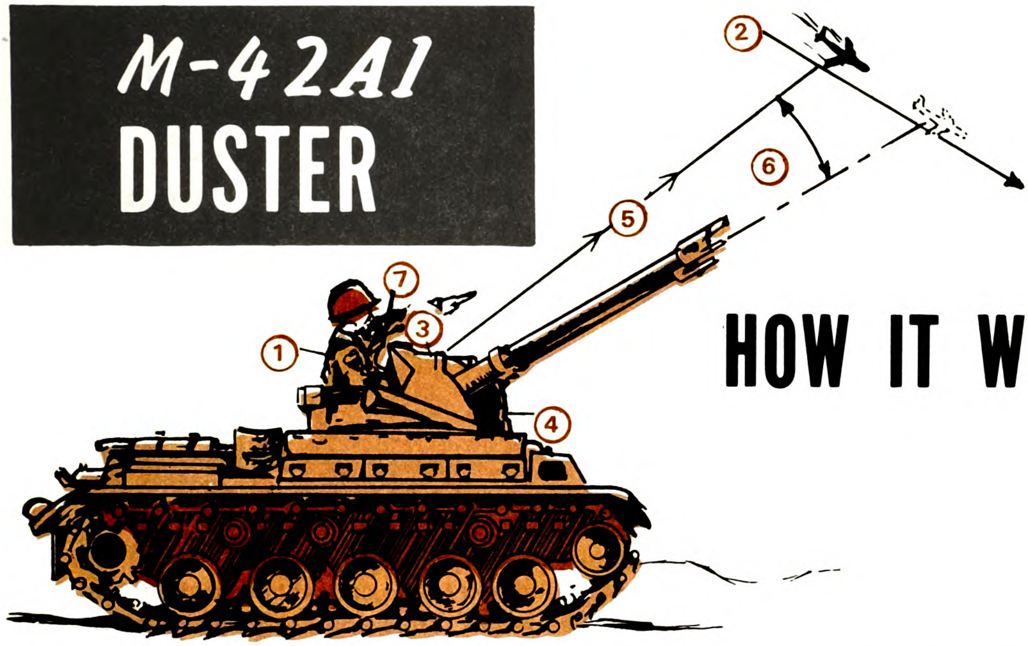
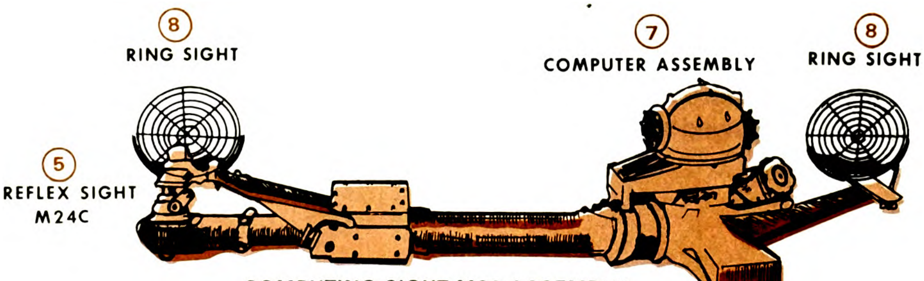
CHAPTER 4 ADA WEAPONS, "HOW THEY WORK"

M-42A1 DUSTER



HOW IT WORKS

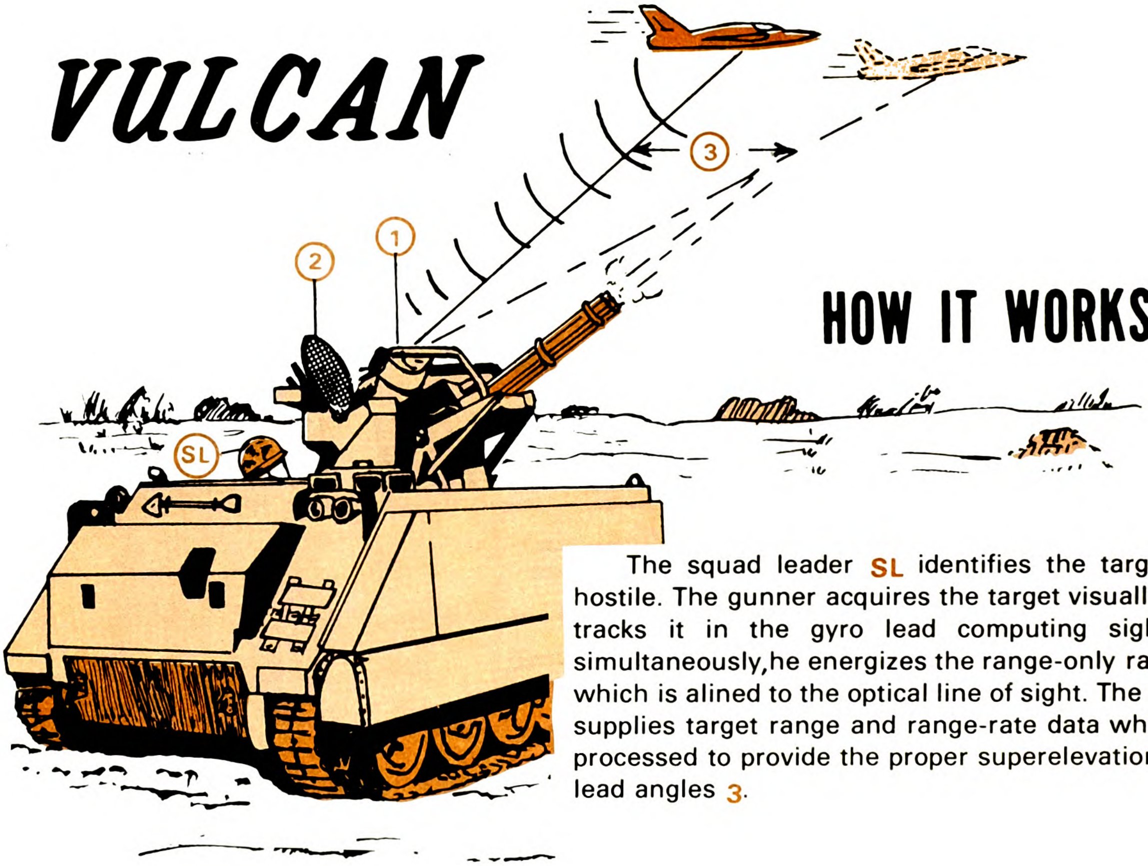
The squad leader 1 designates the target, estimates target speed, determines direction of flight, and the angle of dive or climb 2 and sets these values into the computing sight M38 7. The gunner 3 engages the power drive mechanism and traverses and elevates the gun mount and dual 40-mm guns 4 until the target is centered in the reticle of the reflex sight M24 5. The sight mechanically computes the required lead angle 6 based on target speed and flight direction; superelevation is automatically inserted based on gun elevation. When target-tracking is steady, the gunner reports ON. Upon receiving the report ON, and having determined that the target is within effective range, the squad leader commands FIRE. The gunner commences firing and continues to fire until the target is destroyed or the squad leader commands CEASE FIRING. The normal mode of firing is the power control mode, using the M38 computing sight. An alternate mode of operation is the manual mode. In this mode, the mount and dual-gun are moved in azimuth and elevation by hand operating cranks. When operated in the manual mode, speed ring sights 8 are used for fire control.



COMPUTING SIGHT M38 ASSEMBLY.

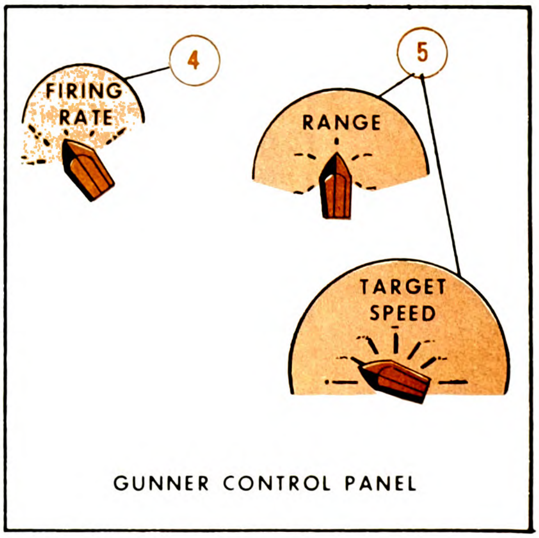
VULCAN

HOW IT WORKS



The squad leader SL identifies the target as hostile. The gunner acquires the target visually and tracks it in the gyro lead computing sight 1; simultaneously,he energizes the range-only radar 2 which is alined to the optical line of sight. The radar supplies target range and range-rate data which is processed to provide the proper superelevation and lead angles 3.

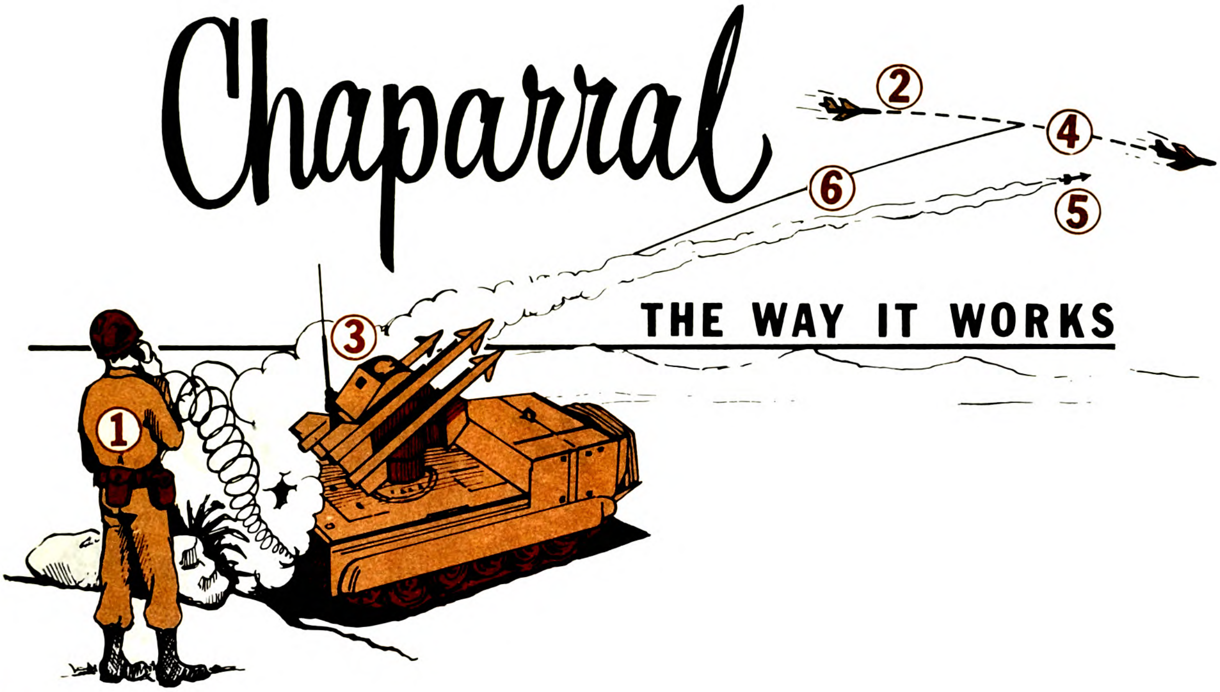
The gunner selects the firing rate of 1,000 rpm, with no burst limit, or 3,000 rpm with a burst limit of 10, 30, 60, or 100 rounds appropriate to the type of target 4 A ready-to-fire lamp lights, signaling to the gunner when to fire. When all conditions of firing have been met, the gunner fires. The normal mode of firing is the radar mode. An alternate mode is the manual mode, wherein the gunner estimates the target range and target speed and sets these estimates on indicator dials on the gunner's control panel 5. The lead computing sight then computes the superelevation and lead angles based on these estimates. Functional characteristics, engagement, and firing procedures are the same for both the self-propelled and towed systems.



GUNNER CONTROL PANEL

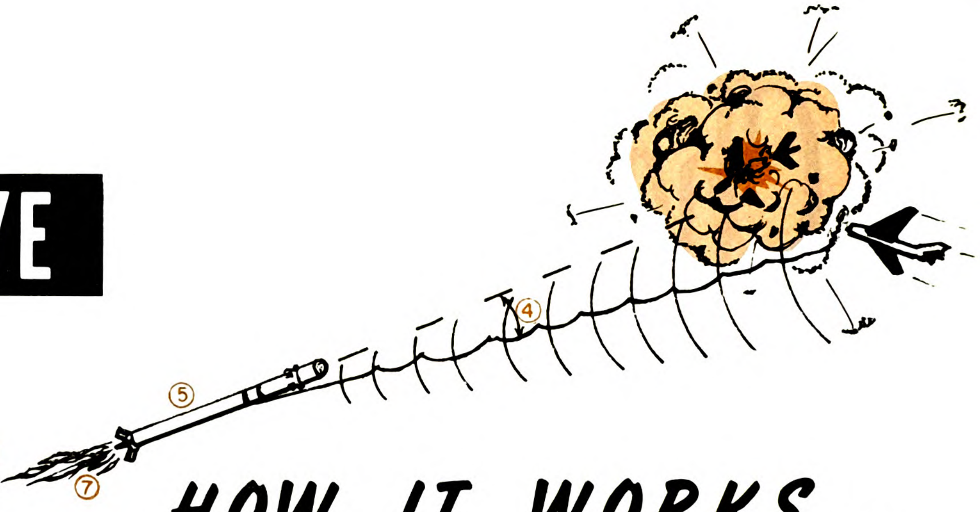
Chaparral

THE WAY IT WORKS



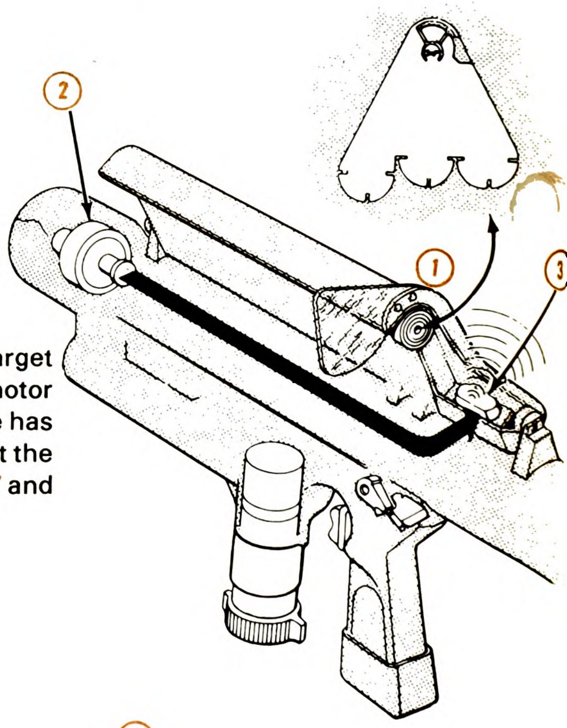
The squad leader **1** identifies target **2** as hostile, commands gunner to ENGAGE. The gunner **3** visually acquires the target, centers it in the reflex optical sight reticle, and establishes smooth tracking **4** until an audible signal tone is received. The gunner maintains the tone, evaluates target range, and makes his decision to fire. When all target engagement requirements are met, the gunner fires one missile **5** as directed by the squad leader. At the time of firing, superelevation **6** is automatically inserted to insure proper missile flight.

REDEYE

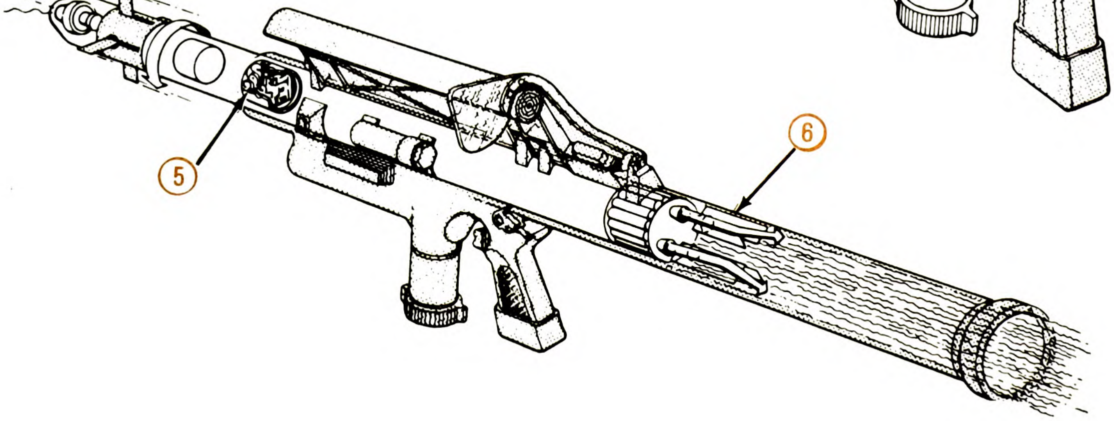


HOW IT WORKS...

On sighting a hostile target, the gunner **G** tracks it visually in an open sight **1**. At the same time, he activates the missile guidance system **2**. A buzzer **3** informs the gunner when the target is acquired and the missile is ready to fire.

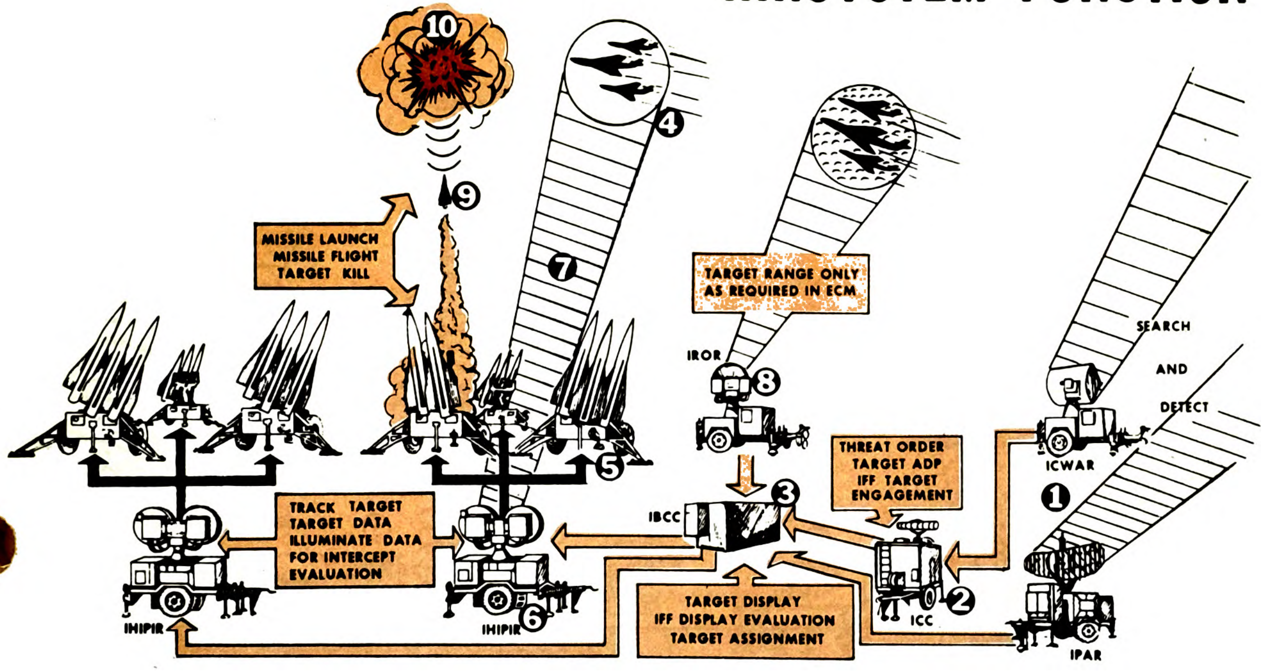


The gunner inserts superelevation and lead **4** to the missile-target line of sight and fires the missile. Upon firing, the ejector motor propels the missile **5** out of the launch tube **6**. When the missile has cleared the launch tube muzzle by a distance sufficient to protect the gunner from blast effect (5-9 meters), the sustainer motor fires **7** and propels the missile the rest of the way to the target.



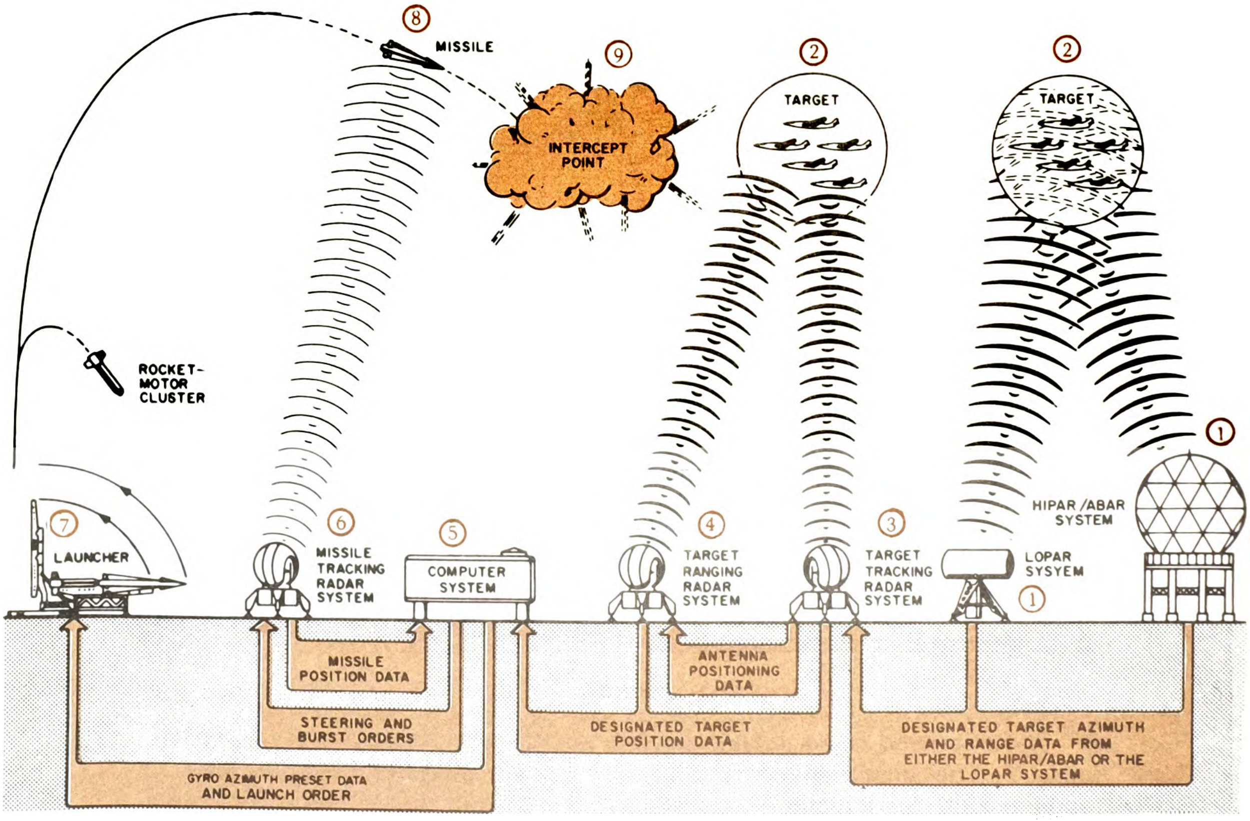
Improved HAWK

.....SYSTEM FUNCTION



The Improved Hawk system detects targets with two types of acquisition radar 1. The improved continuous-wave radar (ICWAR) provides low- to medium-altitude detection coverage. The improved pulse acquisition radar (IPAR) provides medium- to high-altitude, medium-range detection coverage. Following detection, the information coordination central (ICC) 2 allows for target identification, friend or foe (IFF), and automatic data processing (ADP) of target information. The improved battery control central (IBCC) 3 displays target information received from the radars and the ICC. The tactical control officer (in the IBCC) selects targets 4 for engagement and assigns them to a firing section 5 The improved high-powered illuminator radar (IHIPIR) 6 tracks the targets 7 and provides a reference signal to the missile. In an ECM environment, the improved range-only radar (IROR) 8 furnishes ranging information for target engagement. After launch, the missile 9 homes on the target by continuous comparison of the transmitted signal of the IHIPIR with the reflected signal from the target. Using this information to make continuous adjustments in its course, the Hawk missile flies a proportional navigation course to the kill point 10.

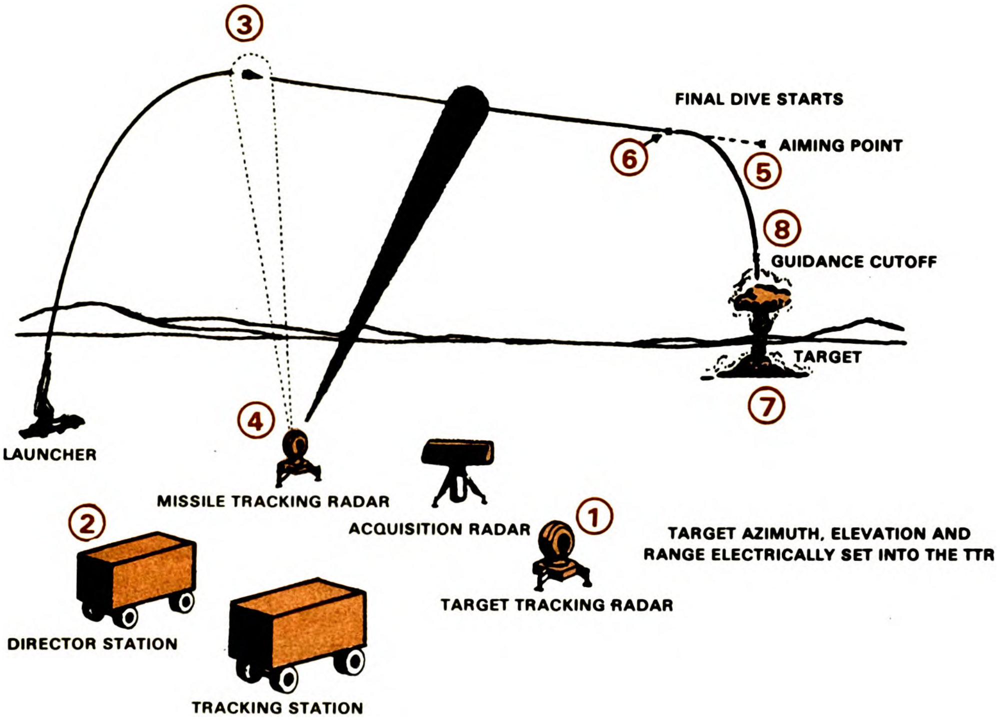
NIKE HERCULES SURFACE TO AIR *Method of Operation*


⑧
MISSILE
⑨
INTERCEPT POINT
②
TARGET
②
TARGET
①
ROCKET-MOTOR CLUSTER
HIPAR /ABAR SYSTEM
⑦
LAUNCHER
⑥
MISSILE TRACKING RADAR SYSTEM
⑤
COMPUTER SYSTEM
④
TARGET RANGING RADAR SYSTEM
③
TARGET TRACKING RADAR SYSTEM
LOPAR SYSYEM
①
MISSILE POSITION DATA
STEERING AND BURST ORDERS
GYRO AZIMUTH PRESET DATA AND LAUNCH ORDER
ANTENNA POSITIONING DATA
DESIGNATED TARGET POSITION DATA
DESIGNATED TARGET AZIMUTH AND RANGE DATA FROM EITHER THE HIPAR/ABAR OR THE LOPAR SYSTEM

The acquisition radars 1 detect the target 2, which, when identified as hostile, is designated to a target tracking radar 3. The target tracking radar, in conjunction with the target ranging radar 4, acquires and tracks the target; measures range, azimuth, and elevation to the target; and continuously sends these data to the computer 5. A third radar, the missile tracking radar 6, locks on the missile on a launcher 7; measures range, azimuth, and elevation of the missile in flight 8 and continuously sends this information to the computer. The computer, knowing the location of both target and missile, continuously computes an intercept point, directs the missile to the intercept point 9 and causes the burst command to be sent to the missile at the appropriate time.

NIKE HERCULES

SURFACE TO SURFACE
Method of Operation



Target range, azimuth, and elevation are set into the target tracking radar 1, and dial settings are made on the computer 2. The missile is fired 3, tracked by the missile tracking radar 4, and steered toward an aiming point above the target 5. At the proper instant the missile is given a dive command 6 to position it in the proper attitude to hit the target 7. After the dive command is executed, the missile tracking radar ceases tracking 8 and the missile continues to the target on a ballistic trajectory.

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CHAPTER 5 COMMAND AND CONTROL SYSTEMS

5-1 GENERAL

Long-and medium-range ADA weapons, such as Nike Hercules, Patriot, and Hawk, operate with electronic command and control systems that are tied in with higher level air defense control facilities, enabling the exchange of aircraft track information on, and direct assignment of hostile aircraft for engagement by these weapons. Electronic control facilities may be established and employed at ADA battalion-, group-, and/or brigade-level command posts. These systems are used in control of the air battle to:

- **Insure the engagement of targets in their order of importance.**
- **Prevent overkill of hostile aircraft.**
- **Prevent engagement of friendly aircraft.**

5-2 MISSILE MENTOR COMMAND AND CONTROL SYSTEM (AN/TSQ-51)

Missile Mentor is a solid-state, mobile ADA command and control system, designed on the modular concept, that allows the addition or deletion of major functions to meet tactical requirements peculiar to a specific air defense. The Missile Mentor system is composed of two subsystems: the operations and equipment trailers which together serve as the air defense control facility and the remote radar integration station which extends the operational range of the system. The Missile Mentor integrates the operation of Nike Hercules and Hawk fire units by acquiring target tracks, processing data, and making target assignment to fire units.

System Components

System components include the equipment trailer and the operations station. Figure 5-1 shows a type installation of a Missile Mentor system. The equipment trailer contains equipment for receiving, processing, and storing data. The operations station contains tracking and tactical display consoles and operations status boards. In a static situation this equipment is normally removed from the trailer and installed in a permanent facility.

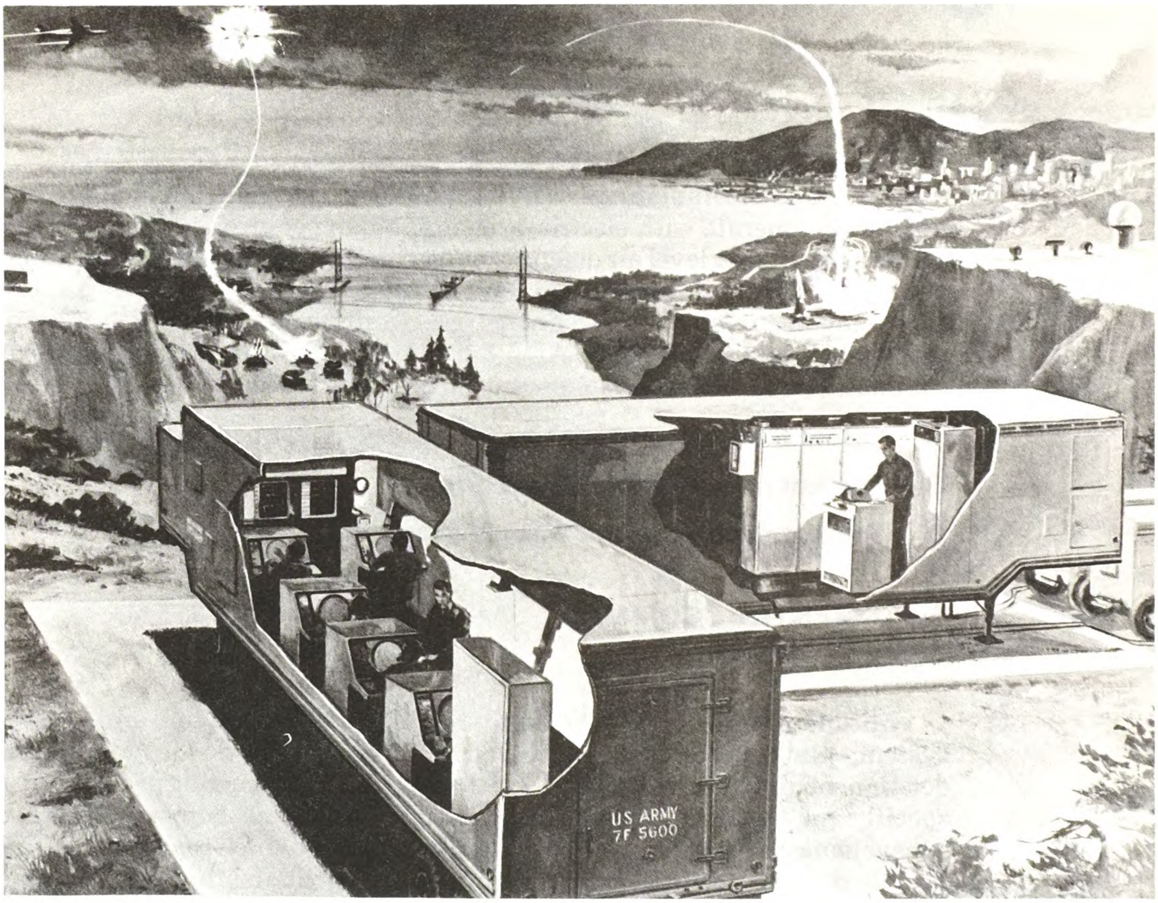

Figure 5-1. Missile Mentor (AN/TSQ-51).

The remote radar integration station (RRIS)(not shown)consists of a trailer containing a track display console and a general purpose digital computer, RRIS s are used to net remotely located radars and supplement the local acquisition radar coverage by supplying processed target track data from these sources.

System Characteristics

The system characteristics and capabilities are classified and may be found in (C) TM 9-1430-560.

How Missile Mentor Works

The major functions performed by the system are target detection, acquisition, identification (friend or foe), track correlation, threat evaluation, fire unit designation, fire unit monitoring, and communications. The system gathers these data—the computer then performs all real-time computations required for target detection, tracking, data exchange, and console displays.

References: (C) TM 9-1430-560, TM 9-1430-560-10/1, TM 9-1430-560-10/2.

5-3 MISSILE MINDER COMMAND AND CONTROL SYSTEM (AN/TSQ-73)

The Missile Minder (fig 5-2) is an ongoing system programed to replace the older systems. The Missile Minder employs advanced electronic technology; it is self-contained, fully automated, and easily transported. The system is available in two configurations: the group level system and the battalion level system. At group level, the primary emphasis is on monitoring air defense activities at subordinate battalion levels. At battalion level the actual direction of the air defense battle occurs. These functions include:

- **Real-time functions of target detection.**
- **Target tracking.**
- **Command and control of firing batteries for engagement.**

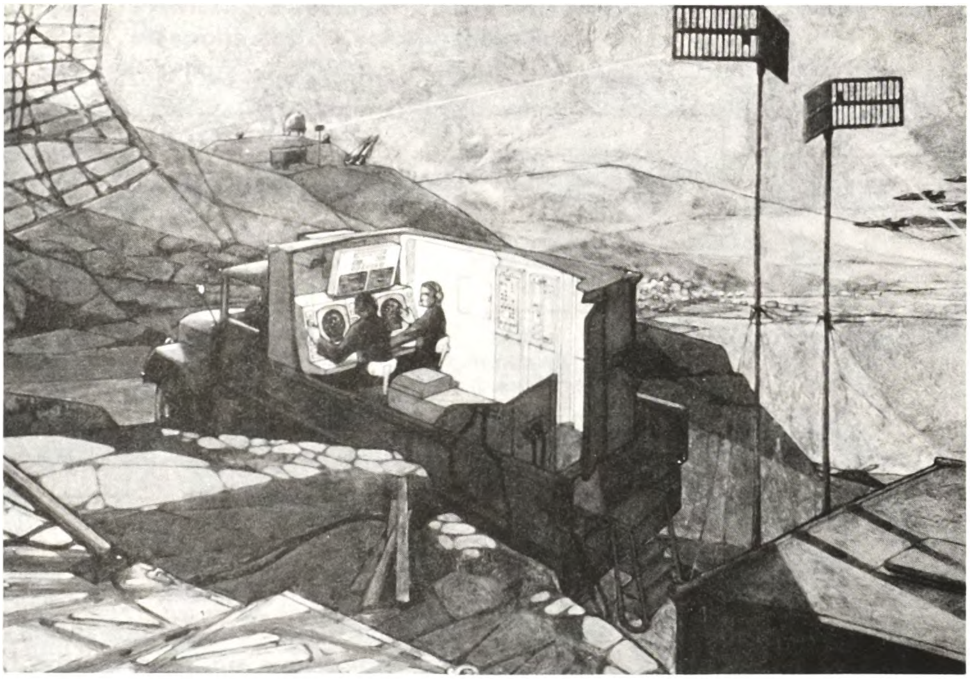

Figure 5-2. The Missile Minder (AN/TSQ-73).

System Components

The Missile Minder system is organized into five major subsystems:

- **Radar interface equipment.**
- **Automatic data processing equipment.**
- **Communications equipment.**
- **Display equipment.**
- **Power equipment.**

The subsystems are enclosed in one air-portable shelter. Within the same shelter are maintenance and repair facilities and equipment to include a work bench, storage for reference material and spare parts, and tools and test equipment sufficient for user maintenance.

System Characteristics

System characteristics and capabilities of the Missile Minder are classified, and may be found in (C) TM 9-1430-651-12-1 (draft) and (C) TM 9-1430-652-12-2 (draft), and (C) FM 44-70 (draft).

How Missile Minder Works

Missile Minder performs the functions of target track correlation, displays identification (IFF), threat evaluation, weapon assignment, data exchange with other systems, and target simulation for training. Figure 5-3 is a simplified flow chart illustrating the sequences of functions performed by the Missile Minder.

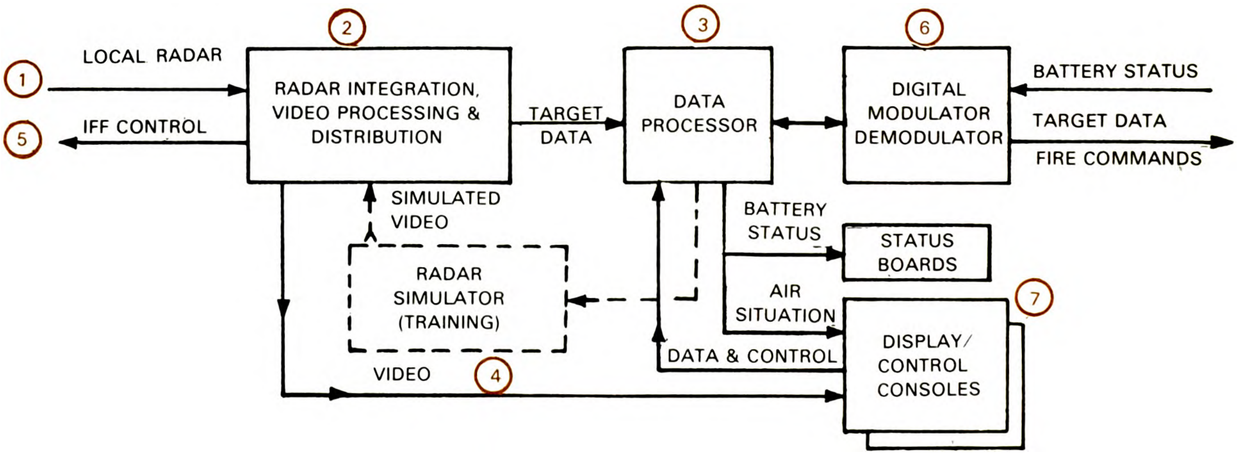

Figure 5-3. Data Flow Chart.

The local/or remote radar detects target 1, transmits target data to the radar interface equipment 2, for processing and distribution to the data processor 3 and as video inputs 4 to the display consoles. The radar interface equipment provides target identification, friend or foe, position and code data 5. The digital MODEMS (Modulator/Demodulator) 6 selects the data format and rate to receive incoming battery status data and transmits target data and fire commands to the batteries. The status boards and display control consoles 7 display processed up-to-the-second information concerning the air-threat situation. These displays provide the commander with essential data to make fast, accurate decisions.

References: TM 9-1425-650-12 (draft), TM 9-1430-655-20-1 (draft).

5-4 BATTALION OPERATIONS CENTRAL, (AN/TSQ-38)

The AN/TSQ-38, (fig 5-4) battalion operations central is deployed in a theater of operations for command and control of Nike Hercules and Hawk units. The system is air-portable by cargo aircraft and can be sling-lifted by helicopter. The AN/TSQ-38 is designed to accompany the ADA battalions with the division or corps in any operational situation.

System Capabilities

The system has the capability of accepting and processing data received from Air Force and ADA group and brigade level control facilities. The AN/TSQ-38 system provides for an equitable distribution of fire by:

- **Permitting the battalion commander to monitor the tactical situation.**
- **Providing a means for instantaneous dissemination of aircraft identity as provided by other agencies.**
- **Providing a means of assigning threat aircraft to an individual weapons battery for engagement.**

The AN/TSQ-38 battalion operations central provides facilities for monitoring the defense activities of from one to eight weapons batteries.

Reference: TM 11-5895-291-10.

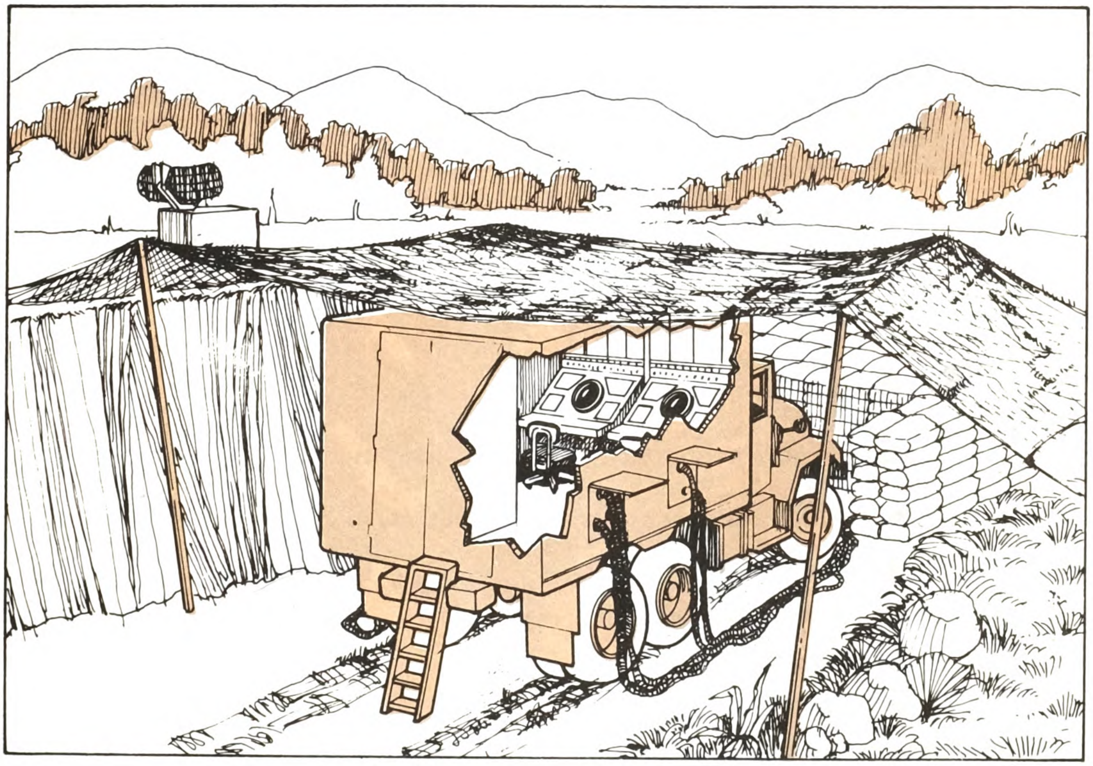

Figure 5-4. AN/TSQ-38, Battalion Operations Central.

USER NOTE: The AN/TSQ-38 is programed for replacement by the AN/TSQ-73 system.

5-5 DATA CONVERTER (AN/GSA-77)

The data converter (fig 5-5) is an on site data processing terminal that permits fire control and coordination between higher level control facilities and Nike Hercules and Hawk missile batteries, or between these missile batteries. The converter is compatible with the Marine Tactical Data System.

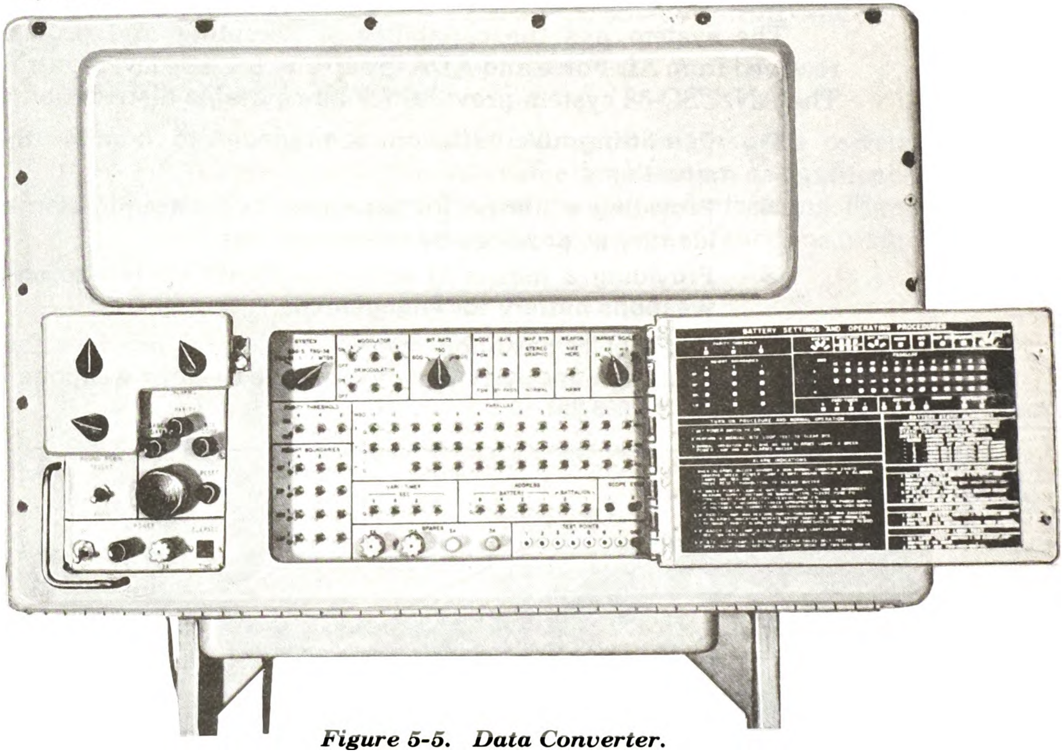

Figure 5-5. Data Converter.

System Components

Major components of the data converter include:

- **Front panel controls and indicators.**
- **Subpanel controls.**
- **Power supply.**
- **Three card bays.**
- **Analog cards.**
- **Circuit card tester.**

These components are contained in an aluminum case.

- **System Characteristics**
  - **Power characteristics: 120 volts, 400 Hz, single phase, 178 watts.**
  - **Digital characteristics: input/output digital transfer rate 750 bits per second; input/output digital work length 59 bits.**
  - **Equipment weight: 135 lb**
  - **Equipment dimensions:**
    - ☐ **Length: 30 in**
    - ☐ **Height: 21.1 in**
    - ☐ **Depth: 11.75 in**
    - ☐ **Displacement: 3.7 cu ft**
- **How the Data Converter Works**

The data converter is mounted within the Nike Hercules director station, in the battery control central of the Basic Hawk system, and in the information coordination central and platoon command post of the Improved Hawk system (fig 5-6).

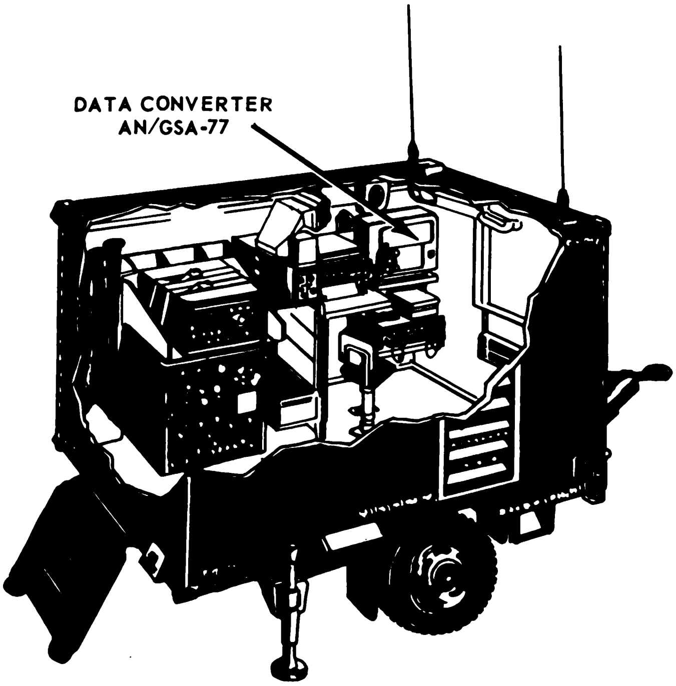

Figure 5-6. Data Converter is in the same location in both the Improved Hawk Battery Information Coordination Central (ICC) and the Improved Hawk Platoon Command Post (IPCP)

The converter receives information from higher level control facilities (e.g. AN/TSQ-73) over automatic data link in coded digital form (fig 5-7). The data converter decodes the incoming digital data and changes it to a form that can be displayed as symbology on the battery consoles and used to fight the air battle. The data converter also receives information from the battery, converts this information into digital data, and transmits the data to higher level control facilities for distribution to adjacent firing batteries and higher echelons.

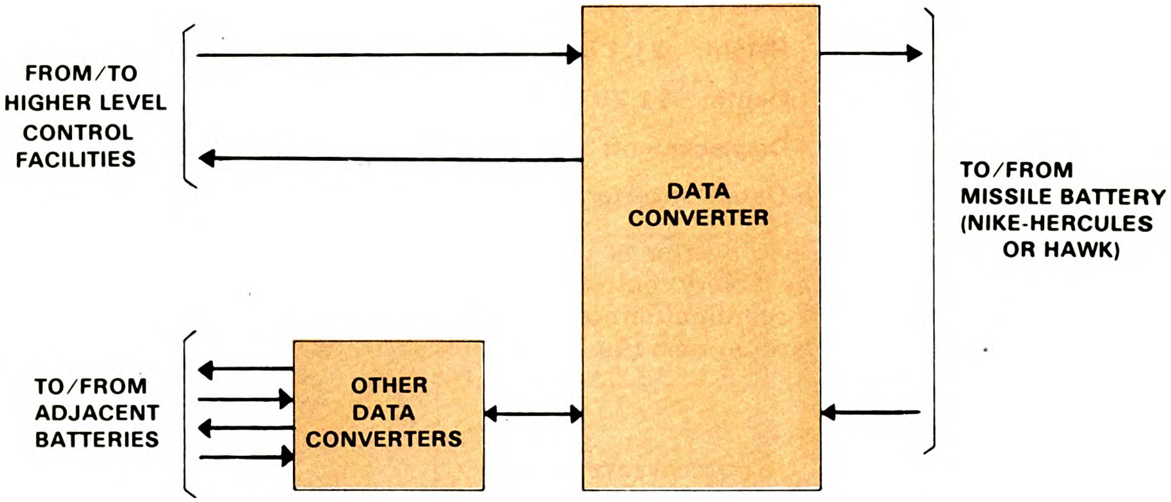
FROM/TO HIGHER LEVEL CONTROL FACILITIES
DATA CONVERTER
TO/FROM MISSILE BATTERY (NIKE-HERCULES OR HAWK)
TO/FROM ADJACENT BATTERIES
OTHER DATA CONVERTERS

Figure 5-7. Data Converter System Data Flow.

Reference: TM 9-1430-580-14.

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CHAPTER 6 RADAR WARNING SYSTEMS

6-1 GENERAL

Air defense radars employ radiofrequency radiations to detect the presence of aerial targets. Air defense artillery units deploy medium range radars to search an assigned area and report information to an evaluation center. These radars provide target infomation, identification and position data to ADA weapon and command and control facilities.

ADA short-range weapon systems are alerted to potential targets in the forward combat area by the short-range, low-altitude defense radar AN/MPQ-49 forward area alerting radar (FAAR).

Long-range detection of aerospace targets (ballistic missiles and aircraft) is a function of the United States Air Force. Sensors in the long-range category can detect a target in excess of 3,000 miles.

6-2 RADAR SET AN/TPS-1G

This is a medium-range, transportable radar set, designed for use as a search radar. The AN/TPS-1G radar is mounted in a truck-portable metal shelter which also contains radio and telephone facilities, IFF equipment, and a manual plotting board and provides shelter for the four-man crew. The complete unit is identified as the electronic search central (AN/GSS-1 or AN/GSS-7) (fig 6-1).

Radar set AN/TPS-1G may detect aircraft at ranges up to 296 kilometers. The radar will operate in temperatures from –65° to 125°F. The complete electronic search central (AN/GSS-1 or AN/GSS-7) can be emplaced or march ordered in less than 1 hour.

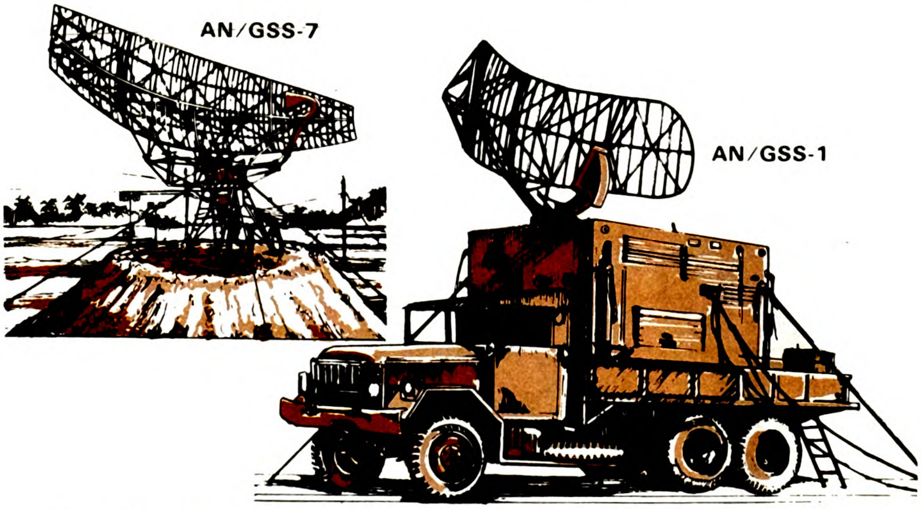

Figure 6-1. Electronic Search Centrals - AN/GSS-1 and AN/GSS-7.

USER NOTE: The major difference between the two search centrals is the antenna. Normally, the AN/GSS-1 is used with the Hawk battalion. The AN/GSS-7 is normally used with the Nike Hercules.

6-3 FORWARD AREA ALERTING RADAR (FAAR) SYSTEM AN/MPQ-49

The FAAR system is a complete, self-contained alerting radar system. It is relatively lightweight, highly mobile, and capable of being deployed under the same climatic and terrain conditions as the Chaparral, Vulcan, and Redeye systems with which it operates. The system is air-portable by cargo aircraft and can be sling-lifted by helicopter.

The system is equipped for on-vehicle intercommunication between crew members, and external voice radio communications.

Functions and Capabilities

The FAAR system aids in denying enemy aircraft undetected access to forward combat areas. Relative position in terms of distance and direction and identification in terms of friend or unknown are obtained from each target. The data is presented on the radar control-indicator and can be transmitted by means of a radiofrequency data link (RFDL) to TADDS at Vulcan, Chaparral, and Redeye weapon locations.

Components

The FAAR system (fig 6-2) consists of several components blended into an operable system (AN/MPQ-49). The Major components are:

- **Radar set, AN/TPQ-32.**
- **Interrogator set, AN/TPX-50 (IFF).**
- **Radio set AN/VRC-46. (2 each; 1-voice, 1-data.)**
- **Truck M56l**
- **Generator Set HF-5-MD**
- **Trailer M101A2**

The FAAR is manned by a three-man section consisting of a section chief, senior FAAR operator, and FAAR operator.

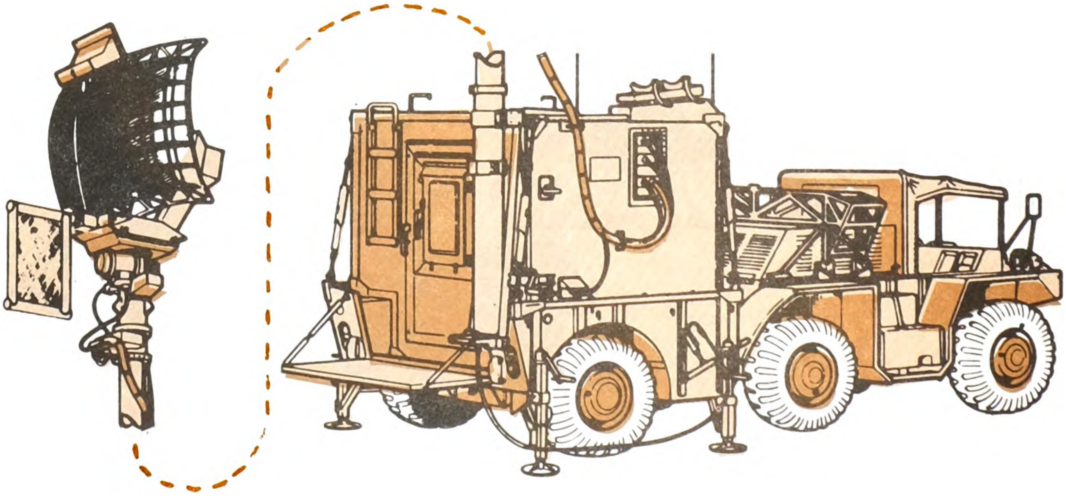

Figure 6-2. Forward Area Alerting Radar (FAAR).

6-4 TARGET ALERT DATA DISPLAY SET (TADDS)

Vulcan/Chaparral squads and Redeye have TADDS (fig 6-3) to provide alerting information concerning targets in their areas. The TADDS is connected by a radio frequency data link (RDFL) to a nearby FAAR. Target data (location and tentative identity) obtained by the FAAR are transmitted over the RFDL for display on the TADDS. The display is a 7x7 matrix of 5-kilometer squares with unknown and a foe indicators in each square. The unknown indicators are orange discs and the friend indicators are green discs. A green disc visible in a square indicates a friend in that area and an orange disc indicates a tentative foe. The TADDS can also receive one-way voice-tell information from the FAAR. The information available from FAAR can only be used if the team/squad knows the FAAR address code, the RFDL frequency, and the FAAR location. Field emplacement is shown at figure 6-4.

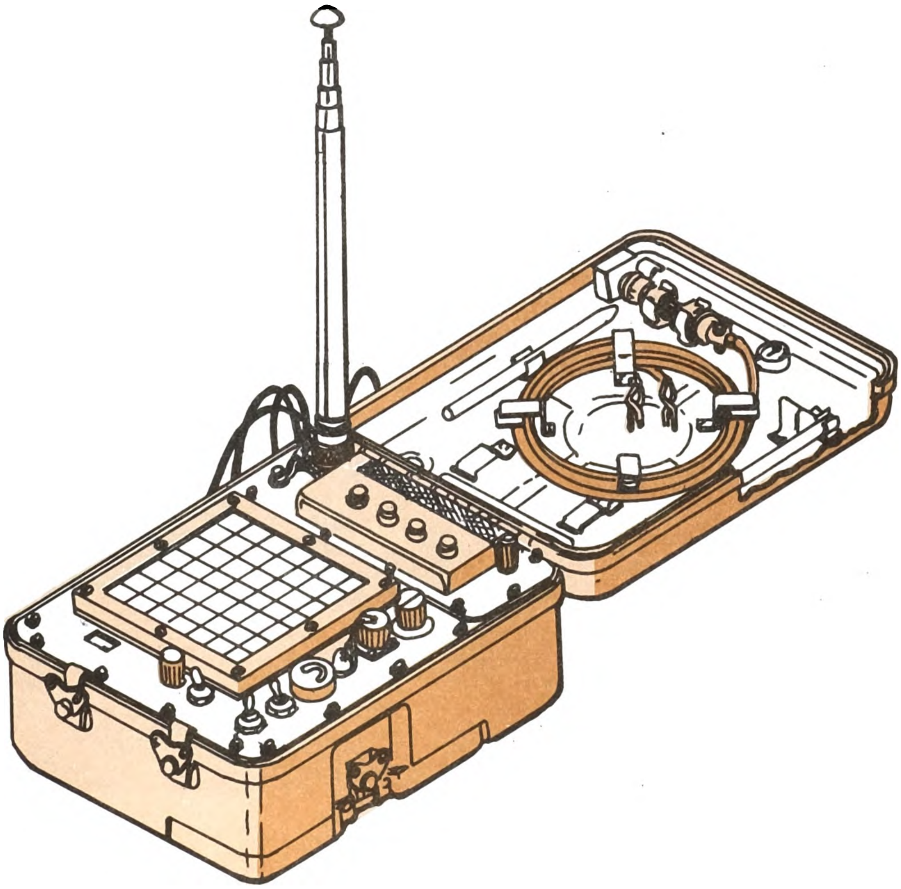

Figure 6-3. Target Alert Data Display Set (TADDS).

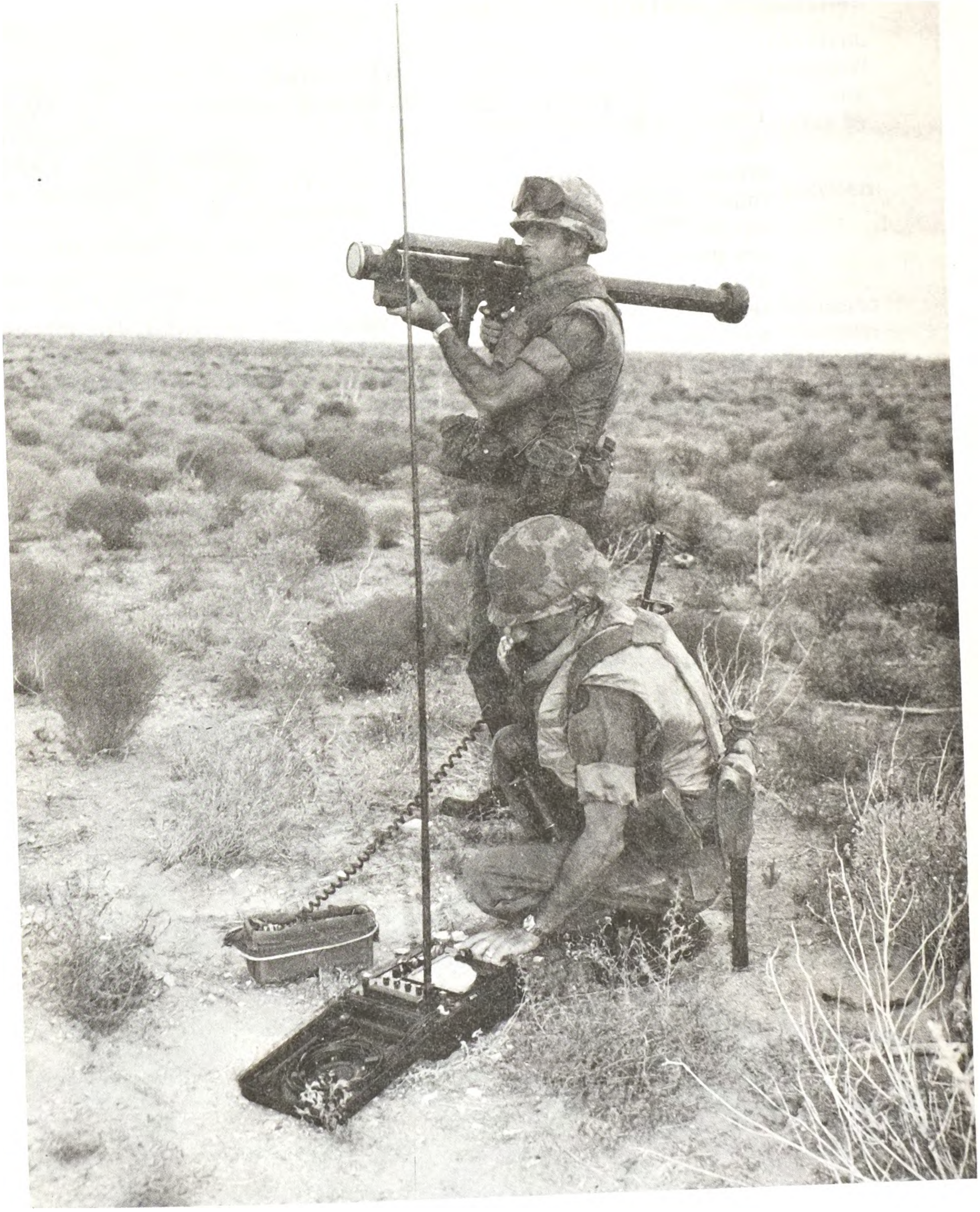

Figure 6-4. TADDS Field Emplacement.

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CHAPTER 7 WEAPONS OF THE FUTURE

7-1 GENERAL

An extensive Department of Defense research, development, and test program to develop and improve air defense capabilities has been underway for many years. ADA weapons now in the various stages of development and test are discussed in this chapter.

7-2 STINGER

The Stinger (fig 7-1) is the second-generation, man-portable, air defense guided missile system; it is programed to replace the current Redeye weapon. Stinger is expected to reach the field in the 1970-1980 time frame.

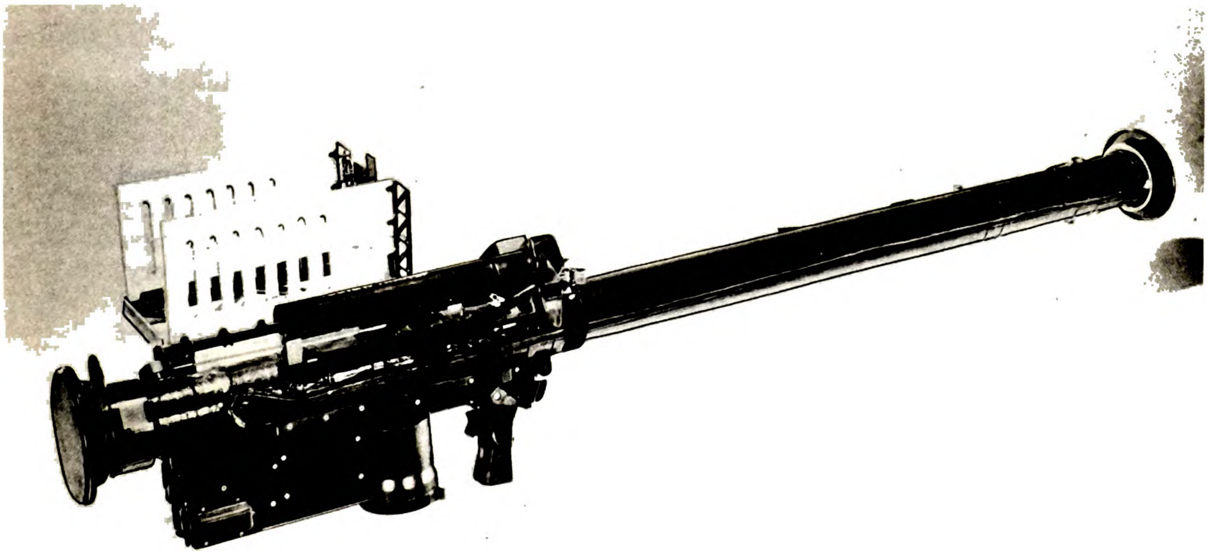

Figure 7-1. Stinger.

Characteristics

- **Guidance - Passive IR homing.**
- **Speed - supersonic.**
- **On-shoulder weight - 33.5 lb.**
- **Length - 60 in.**

Components

The weapon system consists of a certified IR passive homing missile sealed in its launch tube; a separable gripstock containing the launcher electronics; an identification, friend or foe (IFF), antenna; and a battery/coolant unit which provides prelaunch electrical power and seeker coolant gas. The system is designed to minimize user maintenance which is limited to inspection, spot painting, and replacement of selected external parts.

Capabilities

The Stinger has an improved range and velocity capability; improved infrared seeker; and an advanced guidance unit which give it the capability of engaging threat aircraft at any aspect. These features give the Stinger the ability to destroy an attacking jet aircraft prior to its ordnance delivery. The system will also be effective against helicopter, observation, and transport aircraft. The Stinger system is designed to withstand the rigors of a tactical environment and function reliably after exposure to climatic extremes.

Operation

Firing is a simple operation, virtually the same as for the Redeye with the exception of the addition of an IFF procedure to assist in target identification. Unlike Redeye, the gripstock is removed after firing for reuse with the next missile.

7-3 US ROLAND

Roland is a radar-optical, all-weather, short-range, surface-to-air missile system developed jointly by France and West Germany to counter the advanced low-altitude aircraft threat of the near future. The Roland II system adopted for US use from the French/German design, consists of a single vehicle containing a search radar, IFF element, tracking radar, and two launcher arms. The missiles are certified rounds of ammunition and require no maintenance support at organization or DS/GS level. Two missiles are carried on the launcher arms in sealed containers which double as launch tubes. An additional eight rounds are carried in two four-round magazines. Reload of the launcher arms is accomplished automatically. The US Roland is expected to be fully operational during the 1980 time frame.

Targets are detected by the search radar, displayed on the plan position indicator (PPI) with engageability symbols, and interrogated with IFF. When targets are within engagement range, and identified as Foe, the Roland commander initiates the firing sequence.

The US Roland is a self-contained fire unit of modular design mounted on a single vehicle (fig 7-2). It uses pulse doppler radars to detect and track targets that are to be engaged. An optical sight is used to track targets in clear weather and to provide precision target tracking in an intense electronic countermeasures environment. The US Roland can engage targets at all aspects in adverse or clear weather. Maximum range is approximately 6 km. The system crew consists of four personnel.

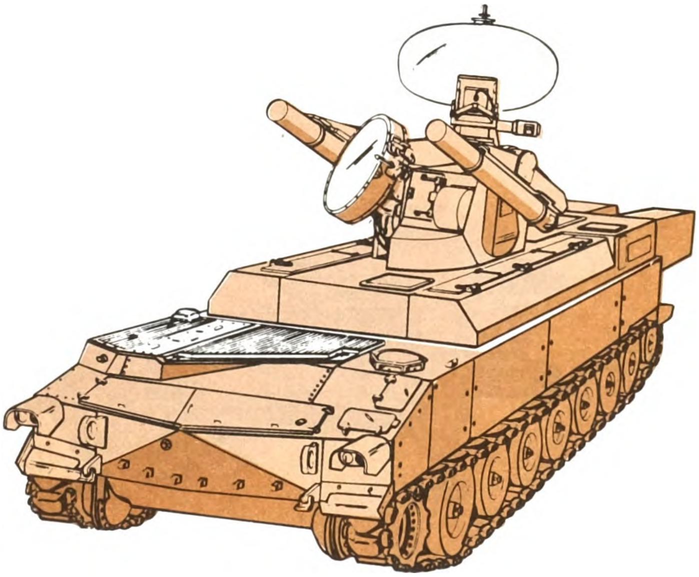

Figure 7-2. Roland Fire Unit.

7-4 THE PATRIOT MISSILE SYSTEM

The cornerstone of the mid-1980 family of air defense weapons will be the Patriot missile system. Its single multifunction phased-array radar performs the tactical functions of searching, detecting, identification, and missile/target tracking necessary to target destruction. The displaced launchers are radio data-linked to the control station permitting remote operation after emplacement. The engagement control station provides automatic control of radar and missile actions; features high-speed digital processing; and provides man/machine interface. The Patriot missile provides high performance against the projected threat. Its guidance system has the capability of operating in an electromagnetic countermeasures environment. In its present configuration, Patriot can handle more than 50 targets and a total of 8 missiles, simultaneously. The system includes an automatic built-in test feature which tests each component on a regular basis.

Radar Set

The radar set provides all radar functions. The radar trailer contains the multifunction radar and its phase-array antenna. The Patriot radar features electronic beam scanning under computer control. In its multifunction operation the ground radar tracks the missile, conveying guidance commands to the missile by means of phase-coded information on the main radar beam.

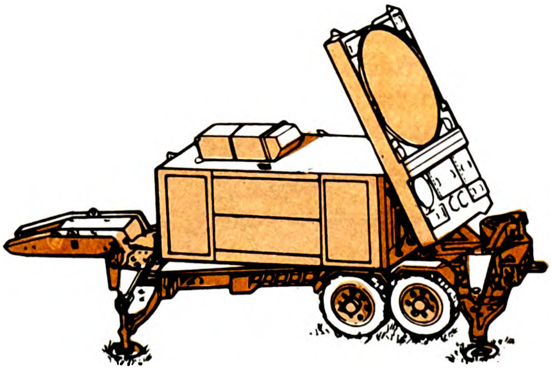

Figure 7-3. Radar Set.

Engagement Control Station

The engagement control station, contained in a truck-mounted shelter, includes a special purpose digital computer that automatically controls both the radar and in-flight missiles. The shelter also contains displays and controls that provide man/machine interface of the system.

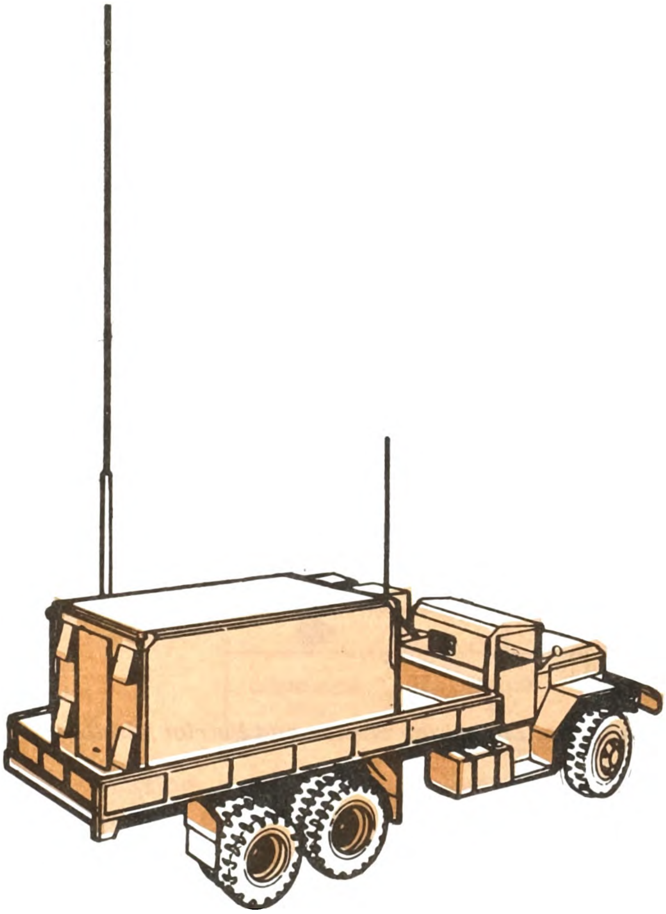

Figure 7-4. Engagement Control Station.

Launching Station

The launching station provides a trainable and stable missile launch platform. The missile cannister is reusable, serving both as a shipping container and launch tube. The launchers, which are powered by individual 15-kw diesel generators, may be sited up to 1 kilometer (0.62 miles) from the engagement control station.

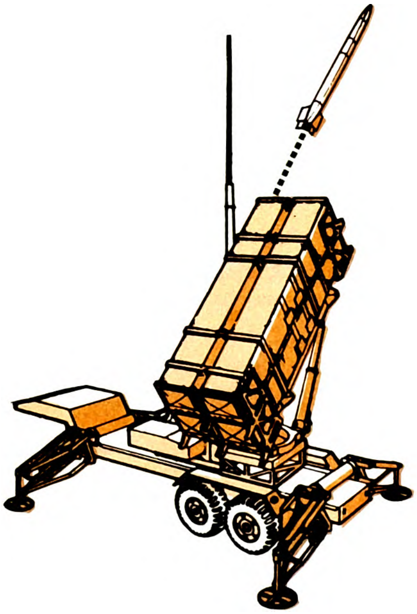

Figure 7-5. Launching Station and Patriot Missile.

Patriot Missile

The Patriot missile is 17.5 feet long and 16 inches in diameter. The missile provides high performance against the projected air-breathing threat spectrum of the 1980 s and features a guidance system that is capable of operating in a severe electronic countermeasures environment. A solid propellant rocket motor boosts the missile to a velocity of more than MACH 3.

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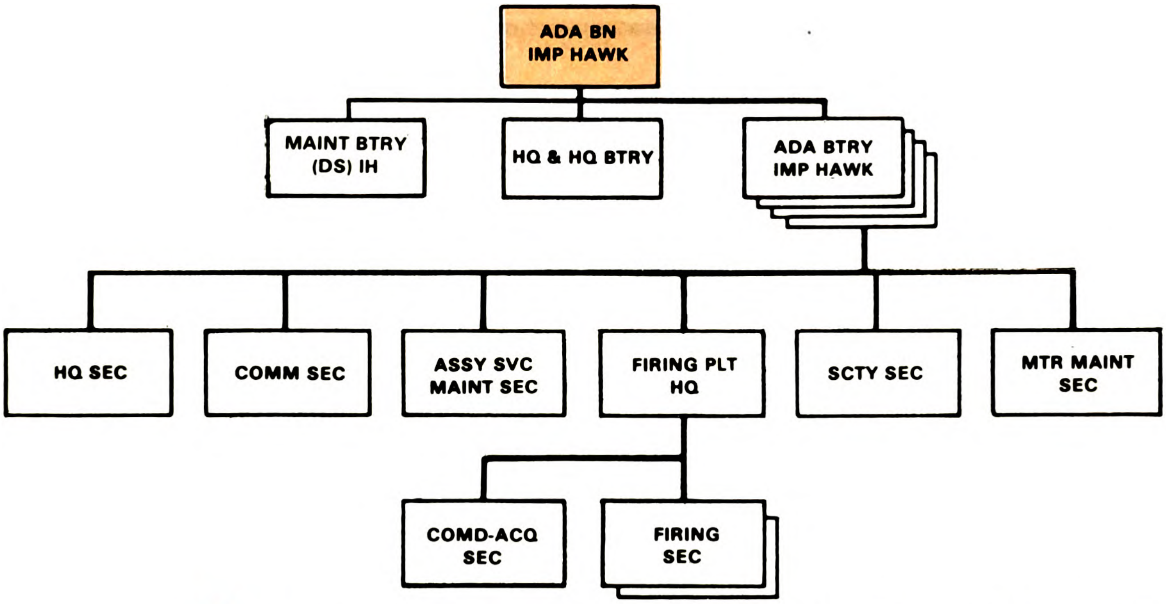
CHAPTER 8 ORGANIZATION - BATTALION AND BELOW

8-1 GENERAL

The organization of ADA units is determined by the mission, the activities necessary for accomplishment of the mission, ADA equipment configuration, and the operational environment. To facilitate the presentation of data concerning the organization, capabilities, and equipment of ADA units, the basic tables of organization and equipment (TOE) under which the units are organized are cited without any alphabetical suffix because TOE s are changed and revised frequently. The current version of TOE s and tables of allowance (TA) should be consulted when detailed information is required. Organizational and equipment data contained in this manual are current as of the date of publication.

8-2 AIR DEFENSE ARTILLERY BATTALION, IMPROVED HAWK, TOE 44-245



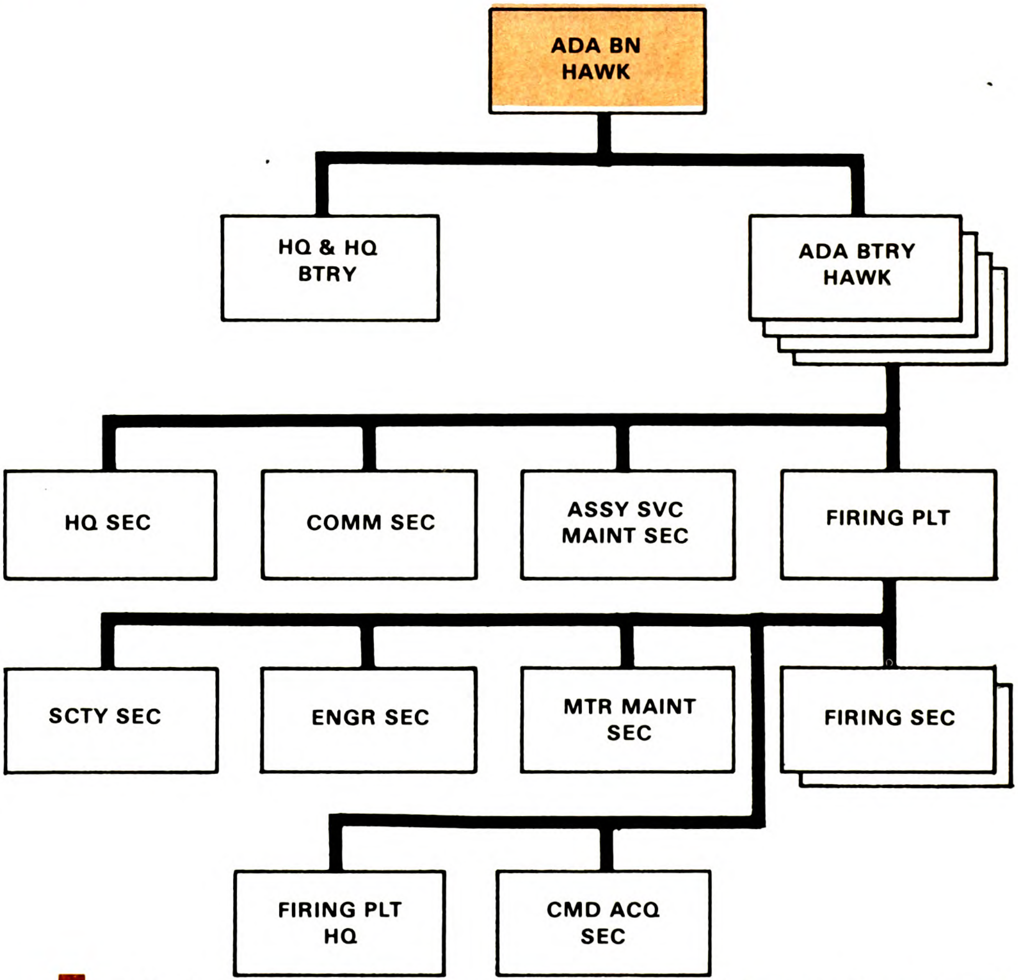
- **Mission.** To provide continuous air defense of assigned installations or areas against the low- and medium-altitude hostile aerial targets.

- **Assignment.** Normally assigned or attached to an air defense artillery group or brigade. (May function as a separate battalion.)

- **Capabilities.** Provides air defense of assigned organizations or priority assets against low- and medium-altitude hostile aerial targets; a command and control system; direct support maintenance of the Improved Hawk missile system, and direct and general support maintenance of the command and control system; and medical service to include operation of the battalion aid station.

- **Allocation.** One or more per defended asset as required.
- **Mobility.** Twenty-five percent mobile in organic vehicles when organized under semimobile TOE. One-hundred percent mobile in organic vehicles when organized under mobile TOE. One-hundred percent air portable in US Air Force aircraft.
- **Personnel.** Officers 41; Warrant Officers 19; Enlisted 815; Total 875.

8-3 AIR DEFENSE ARTILLERY BATTALION, HAWK (TOWED), TOE 44-235



- **Mission.** To provide continuous air defense of assigned installations or areas against low- and medium-altitude hostile aerial targets.
- **Assignment.** Normally assigned or attached to an air defense artillery group. (May function as a separate battalion.)

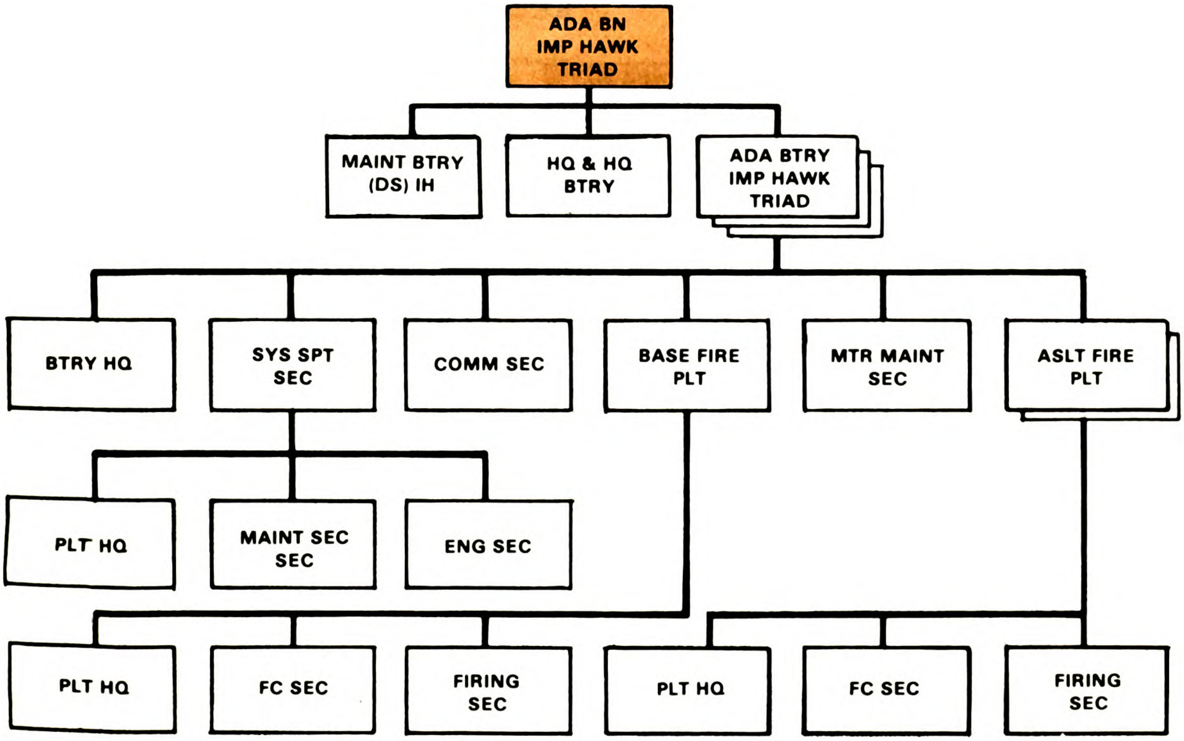
Capabilities. Provides air defense of organizations or priority assets against low- and medium-altitude hostile aerial threat; an ADA command and control system; signal communications for the command and control system; direct support maintenance of organic engineer, ordnance, and signal type equipment peculiar to the Hawk missile system; and medical service to include operation of the battalion aid station. Receives, stores and issues repair parts as required to support the maintenance mission.

Allocation. One or more per defended asset as required.

Mobility. Twenty-five percent mobile in organic vehicles when organized under semimobile TOE. One-hundred percent mobile in organic vehicles when organized under mobile TOE. One-hundred percent air portable in US Air Force aircraft.

Personnel. Officers 37; Warrant Officers 16; Enlisted 722; Total 775.

8-4 AIR DEFENSE ARTILLERY BATTALION, IMPROVED HAWK (TRIAD), TOE 44-265



Mission. To provide continuous air defense of assigned installations or areas against low- and medium-altitude hostile aerial targets.

Assignment. Normally assigned or attached to an air defense artillery group. (May function as a separate battalion.)

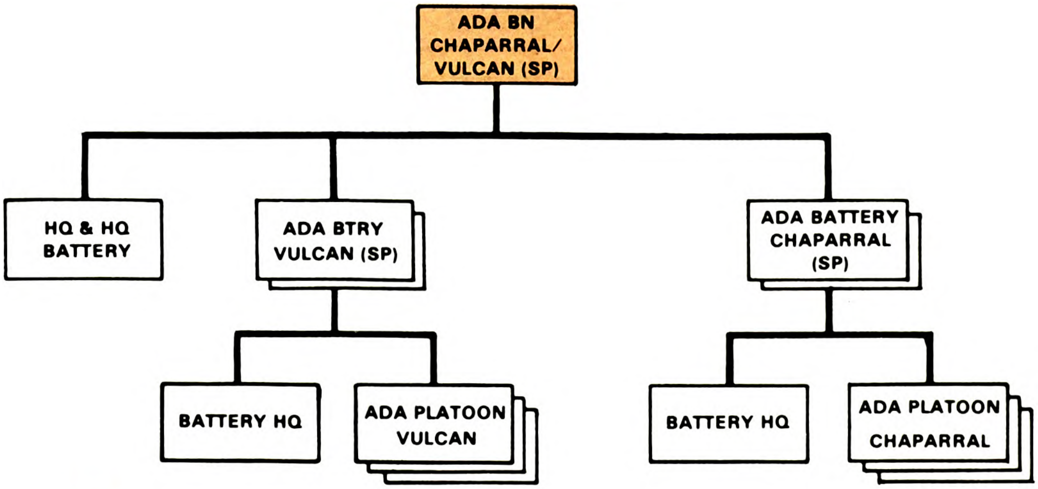
Capabilities. Provides air defense of organizations or priority assets against low- and medium-altitude hostile aerial targets; battalion command and control system; wire and radio communications for the battalion and automatic data link for the command and control system; direct support maintenance of organic engineer, ordnance, and Hawk peculiar equipment, and direct and general support maintenance of the command and control system. Receives, stores, and issues repair parts required to support the maintenance mission. Provides medical service to include operation of the battalion aid station.

Allocation. Normally one per committed division.

Mobility. One-hundred percent mobile in organic vehicles. One-hundred percent air portable in US Air Force aircraft.

Personnel. Officers 37; Warrant Officers15; Enlisted 723; Total 775.

8-5 AIR DEFENSE ARTILLERY BATTALION, CHAPARRAL/VULCAN, SP, ARMORED DIVISION, INFANTRY DIVISION, OR INFANTRY DIVISION (MECHANIZED), TOE 44-325



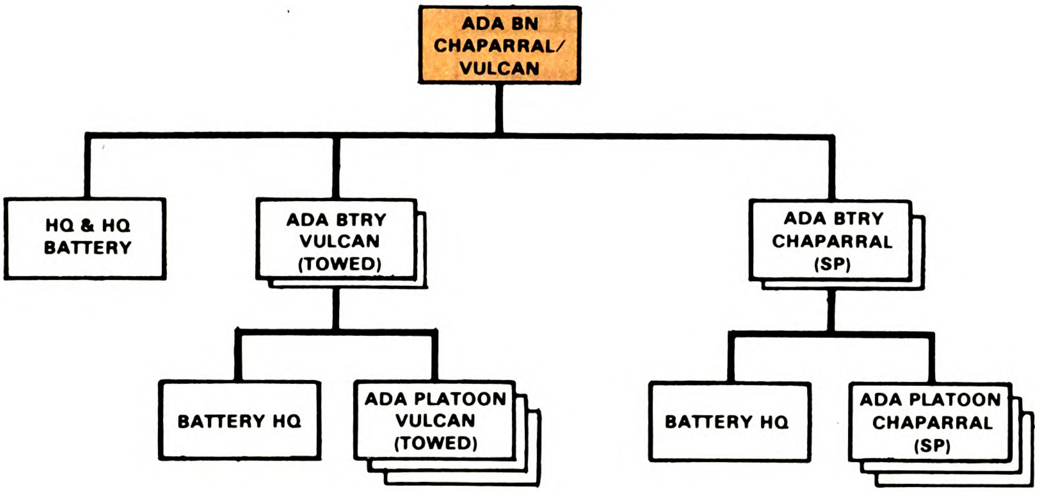
Mission. To provide air defense for forward combat elements against low-altitude hostile aircraft and to attack and destroy surface targets as required.

Assignment. Organic to armored division, infantry division, and infantry division (mechanized).

Capabilities. Provides air defense against low-altitude hostile aircraft; engagement of surface targets with the Vulcan weapon system when not required in the air defense role; forward area alerting radar capability when so augmented; and medical service to include operation of the battalion aid station.

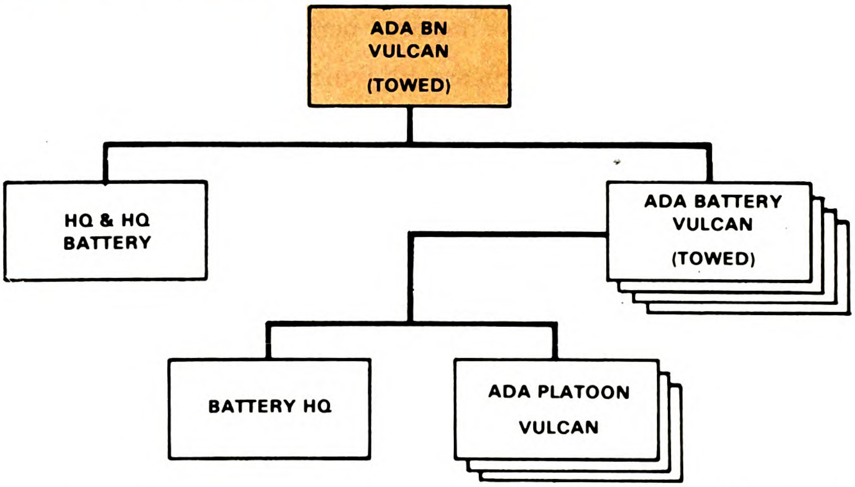
- **Allocation.** One per armored division, infantry division, or infantry division (mechanized).
- **Mobility.** One-hundred percent mobile in organic vehicles.
- **Personnel.** Officers 40; Warrant Officers 16; Enlisted 697; Total 753.

8-6 AIR DEFENSE ARTILLERY BATTALION, CHAPARRAL (SELF-PROPELLED), VULCAN (TOWED), TOE 44-725, (NON-DIVISIONAL)



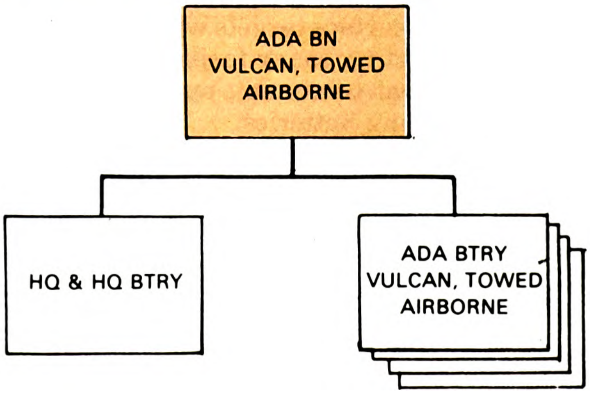
- **Mission.** To provide air defense for corps and theater army combat elements, areas, or installations against attack by low-altitude hostile aircraft and to attack and destroy surface targets as required.
- **Assignment.** Normally assigned or attached to an air defense artillery group which supports corps or theater army.
- **Capabilities.** Provides air defense against low-altitude hostile aircraft. Attacks surface targets with the Vulcan weapon system. Provides forward area alerting radar facility. Provides medical service to include emergency medical treatment; operation of a battalion aid station, and aidmen to the firing batteries.
- **Allocation.** To each corps or theater army as required.
- **Mobility.** One-hundred percent mobile in organic vehicles. One-hundred percent air portable in US Air Force aircraft.
- **Personnel.** Officers 34; Warrant Officers 7; Enlisted 535; Total 576.

8-7 AIR DEFENSE ARTILLERY BATTALION, VULCAN (TOWED), AIR ASSAULT DIVISION, TOE 44-435



- **Mission.** To provide air defense for the air assault division against low-altitude hostile aircraft and to attack and destroy hostile surface targets as required.
- **Assignment.** Organic to the air assault division.
- **Capabilities.** Provides air defense against low-altitude hostile aircraft; engagement of surface targets, when required; forward area alerting radar facility; and medical service limited to emergency medical treatment and aidmen to all batteries.
- **Allocation.** One per air assault division.
- **Mobility.** Fifty percent mobile in organic vehicles. One-hundred percent air portable in Army or US Air Force aircraft.
- **Personnel.** Officers 35; Warrant Officers 6; Enlisted 438; Total 479.

8-8 AIR DEFENSE ARTILLERY BATTALION, VULCAN (TOWED), AIRBORNE DIVISION, TOE 44-425



- **Mission.** To provide air defense for the airborne division against attack by low-altitude hostile aircraft and to attack and destroy hostile surface targets as required.

- **Assignment.** Organic to airborne division.

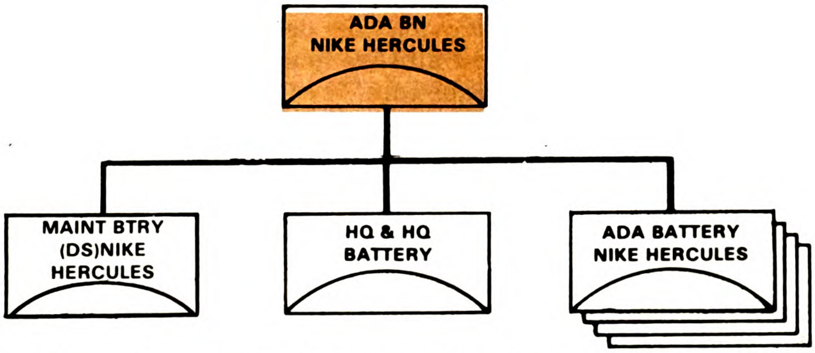
- **Capabilities.** Provides short-range air defense against low-altitude hostile aircraft; engagement of surface targets, when required; forward area alerting radar facility; and medical service, evacuation of casualties, and aidmen to firing batteries. Performs landing by parachute and aircraft.

- **Allocation.** One per airborne division.

- **Mobility.** Eighty percent mobile in organic vehicles. One-hundred percent air portable in US Air Force aircraft.

- **Personnel.** Officers 38; Warrant Officers 7; Enlisted 500; Total 545.

8-9 AIR DEFENSE ARTILLERY BATTALION, NIKE HERCULES, TOE 44-535



- **Mission.** To provide air defense of assigned organizations critical assets against medium- and high-altitude hostile aerial targets, and to provide guided missile fires on designated surface targets.

- **Assignment.** Normally assigned or attached to an air defense artillery group or brigade in support of a corps or theater army.

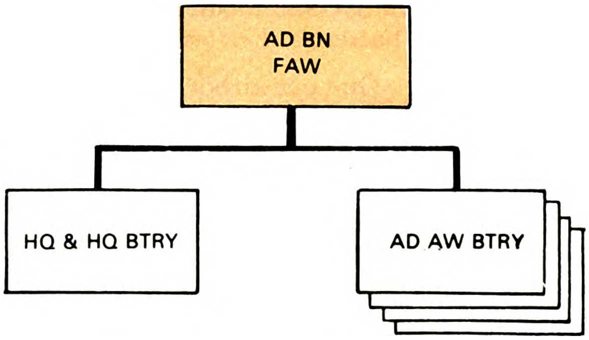
- **Capabilities.** Provides air defense of organizations or priority assets against medium- and high-altitude hostile targets; fires against selected surface targets; direct support maintenance of equipment peculiar to the Nike Hercules missile system, and direct and general support maintenance of the command and control system; and medical service to include operation of battalion aid station. Receives, stores, and issues repair parts required to support the maintenance mission.

- **Allocation.** One or more per defended asset as required.

- **Mobility.** Forty percent mobile in organic vehicles. One-hundred percent air portable in US Air Force aircraft.

- **Personnel.** Officers 34; Warrant Officers 7; Enlisted 535; Total 576.

8-10 AIR DEFENSE ARTILLERY BATTALION, AUTOMATIC WEAPONS, SELF-PROPELLED, TOE 44-85



- **Mission.** To provide air defense for forward combat elelments against attack by low-altitude hositle aircraft and to attack and destroy surface targets as required.

- **Assignment.** Normally assigned to a division for deployment as required.

- **Capabilities.** Provides short-range air defense against low-altitude aircraft, highly mobile automatic weapon fire against terrestrial and waterborne targets, and medical service to include operation of a battalion aid station.

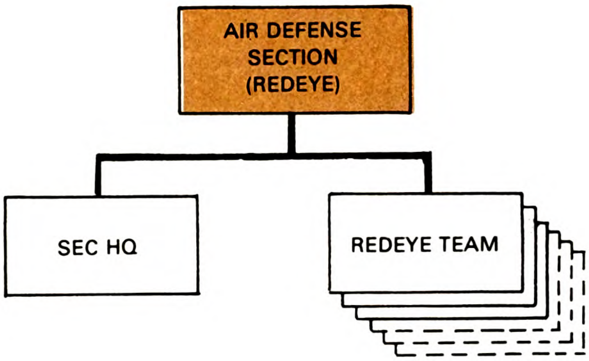
- **Allocation.** One or more to division or corps as required to insure availability of one battalion per committed division.

- **Mobility.** One-hundred percent mobile.

- **Personnel.** Officers 36; Warrant Officers 2; Enlisted 657; Total 695.

8-11 REDEYE AIR DEFENSE ORGANIZATIONS

REDEYE AIR DEFENSE SECTION



- **Mission.** To provide short-range air defense of tactical operations, critical assets, and moving columns against low-altitude hostile aircraft.

- **Assignment.** Organic to battalions or squadrons of armored, airborne, air assault, infantry, and mechanized infantry divisions. Assigned or attached to separate brigades, armored cavalry regiments, nondivisional artillery battalions, and selected task units.

- **Capabilities.** Provides command, control, and supervision of the air defense operations of the parent unit; communications with assigned or attached teams; training support to the teams; supervision of maintenance; and issue and storage of basic load of Redeye weapons.

- **Allocation.** Normally one per combat or cannon field artillery battalion and like units.

- **Mobility.** Same mobility characteristics as parent unit.

- **Personnel.**
  - Section Leader - Lieutenant
  - Section Sergeant - E6
  - Radio Operator - E3

- **Summary of Equipment.** *

■ Truck, ¼-Ton, 4X4, W/Trailer, W/E	1
■ Radio Set AN/VRC-48 Mtd in ¼-Ton Truck	1
■ Redeye Training Set M76	1
■ Target Alert Data Display Set (TADDS)	1

*Equipment by type and amount may vary according to unit TOE.

REDEYE TEAM

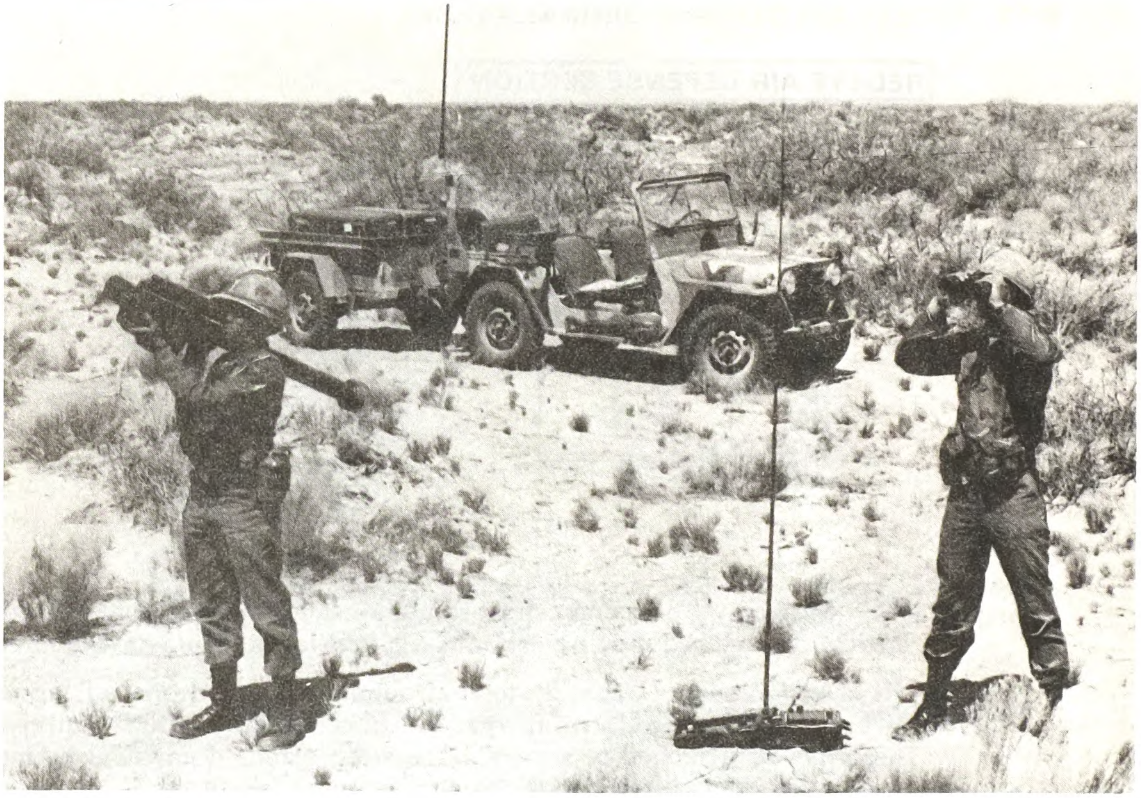


Figure 8-1. Redeye Team.

- **Mission.** To provide air defense of small combat and combat support units and critical assets against low-altitude aircraft.

- **Assignment.** Three or more teams to a Redeye air defense section.

- **Capabilities.** Delivers effective fire against low-altitude hostile aircraft. Furnishes the firing capability that enables the air defense section to accomplish its mission. Maintains team equipment. Stores, transports, and maintains basic load of Redeye weapons.

- **Allocation.** Normally one team per company-size unit within the maneuver battalion/squadron; one team per cannon firing battery within the field artillery battalion; one team per firing platoon in ADA batteries.

- **Mobility.** Same as the supported unit.

- **Personnel.**
  - Team Chief - Sgt (E5)
  - Gunner - Cpl or Spec (E4)

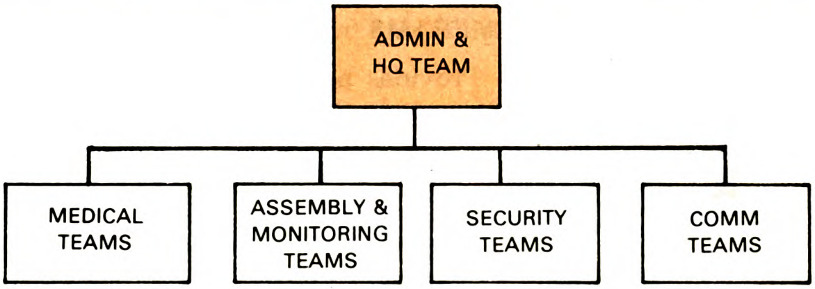
Summary of Equipment. *

Truck, ¼-Ton, 4X4, W/Trailer, W/E	1
Receiver, AN/GRC-160, Mtd in ¼-Ton Truck	1
Remote Set AN/GRA-39	1
Binoculars, 7x50, mil ret	2
Compass	1
Telephone Set TA-1PT	2
Wire, WD-1, 1 mile	1
Target Alert Data Display Set (TADDS)	1
Redeye Field Handling Trainer	1

*Equipment by type and amount may vary according to parent unit TOE.

8-12 US ARMY AIR DEFENSE ARTILLERY MISSILE WARHEAD SUPPORT ORGANIZATION, TOE 44-500

US ARMY ARTILLERY DETACHMENT (AIR DEFENSE) (MISSILE WARHEAD SUPPORT)



Mission. To provide by team composition for the custody, control, storage, organizational maintenance support and monitoring of nuclear warhead sections and components (or nonnuclear components) in support of a Nike Hercules unit of an allied nation. To perform nuclear warhead section/missile mating installation or operations by team composition, depending upon tactical and logistical considerations.

Assignment. Teams may be attached or assigned as required to fixed strength units or may be organized into support units to perform custodial and monitoring functions.

Capabilities. The capabilities of units organized under this table vary with the size and grouping of teams.

Allocation. Normally one detachment, with appropriate teams per supported surface-to-air missile battalion (equivalent to a US ADA missile battalion, Nike Hercules).

Mobility. Mobility capability is provided by host nation. The degree of mobility varies with each team and is dependent upon the type of function performed.

Personnel. Officers 6; Warrant Officers 1; Enlisted 44; Total 51

BREAKDOWN OF TEAMS

TEAM AA, DETACHMENT HEADQUARTERS

- **Capabilities.** Command and control of two or more assembly and monitoring teams and security teams.
- **Basis of Allocation.** One per support SAM missile battalion utilizing one or more support teams.
- **Personnel.** Two officers, 1 warrant officer, and 7 enlisted men.

TEAM EA, ASSEMBLY AND MONITORING TEAM

- **Capabilities.** Provides qualified personnel and equipment to supervise and accomplish nuclear warhead section/missile mating, nuclear warhead and components servicing, and nuclear warhead monitoring.
- **Basis of Allocation.** Normally one per each support SAM missile fire unit.
- **Personnel.** Three officers and 9 enlisted men.

TEAM FA, SECURITY TEAMS

- **Capabilities.** Provides personnel and equipment to supervise and maintain continuous custody of nuclear warhead sections or components at supported SAM fire units sites.
- **Basis of Allocation.** Normally one per each supported SAM fire unit with two storage compartments or launcher pits.
- **Personnel.** Fourteen enlisted men.

TEAM FB, SECURITY

- **Capabilities.** Provides personnel and equipment to augment team EA when more than two storage compartments are used.
- **Basis of Allocation.** Normally one per each additional storage compartment or launcher pit.
- **Personnel.** Three enlisted men.

TEAM GA, COMMUNICATIONS

- **Capabilities.** Provides personnel and equipment for the operation and maintenance of radio nets within the air defense artillery missile warhead support organization and to higher headquarters.
- **Basis of Allowance.** Normally one per each supported SAM battalion.
- **Personnel.** Four enlisted men.

TEAM GB, COMMUNICATIONS

- **Capabilities.** Provides personnel to reinforce the operational capabilities of team GA as required.

- **Basis of Allocation.** Normally one or more when 24-hour radio operation requires augmentation.
- **Personnel.** One enlisted man.

TEAM GC, COMMUNICATIONS

- **Capabilities.** Provides personnel to reinforce the operational capabilities of team GA and/or operate as required, radio/telephone facilities for supported SAM fire units.
- **Basis of Allocation.** Normally one or more where 24-hour communication operation is required.
- **Personnel.** One enlisted man.

TEAM HA, MEDICAL AID STATION

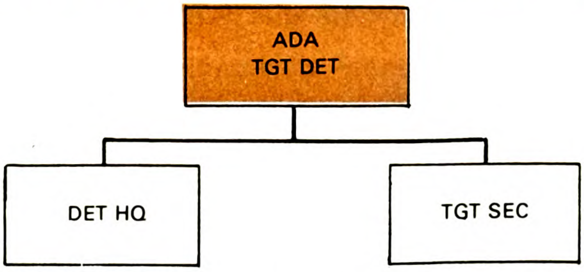
- **Capabilities.** Provides personnel and equipment for supervision of medical aid station to provide unit level medical support.
- **Basis of Allocation.** One per air defense artillery missile warhead support organization.
- **Personnel.** One officer and four enlisted men.

TEAM HB, AMBULANCE DETAIL

- **Capabilities.** Provides minimum personnel and equipment for operation of ambulance team.
- **Basis of Allocation.** Augments team HA on a basis of one per four or a fraction additional troop concentration.
- **Personnel.** One enlisted man.
- **Summary of Equipment**

Equipment authorizations are established by current supply directives. Equipment is authorized in the minimum essential quantities and types necessary to accomplish the mission of the warhead support organization. These allowances may be decreased or omitted, or additional equipment authorized, when required, at the direction of the major command.

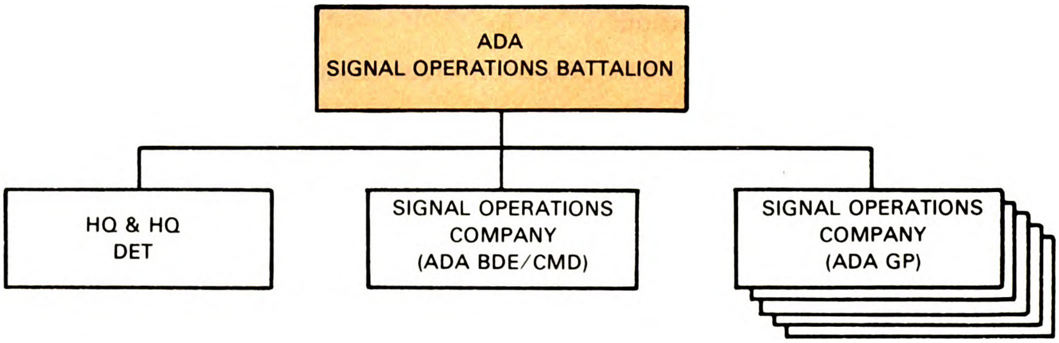
8-13 RADIO CONTROLLED AERIAL TARGET DETACHMENT, TOE 44-510



- **Mission.** To operate and maintain radio-controlled aerial targets for air defense artillery training and target practice.

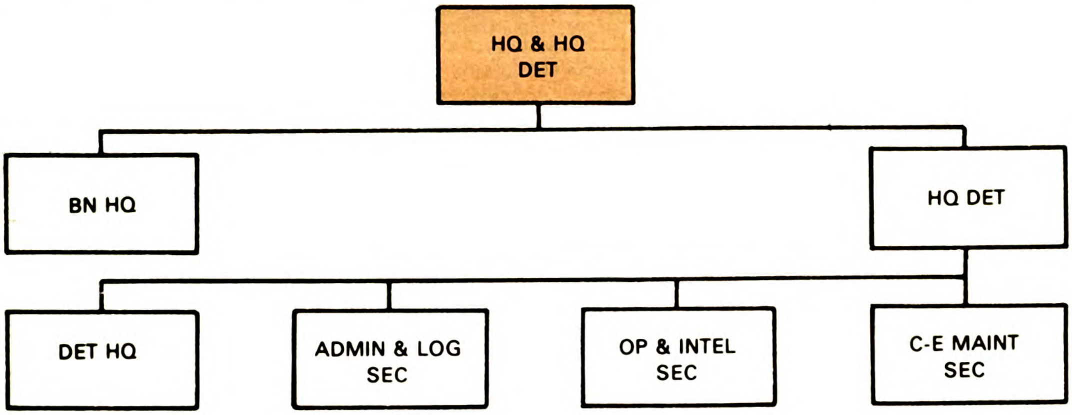
- **Assignment.** Normally attached to another air defense artillery unit when required.
- **Capabilities.** Provides low-speed aerial targets for target tracking practice for air defense artillery automatic weapon units and guided missile units, and organizational maintenance for ground control equipment and radio-controlled airplanes.
- **Allocation.** One or more to a major command as required.
- **Mobility.** Fifty percent mobile.
- **Personnel.** Officers 1; Enlisted 18; Total 19.

8-14 AIR DEFENSE ARTILLERY SIGNAL OPERATIONS BATTALION, TOE 11-175 (ADA BDE)


ADA
SIGNAL OPERATIONS BATTALION
HQ & HQ DET
SIGNAL OPERATIONS COMPANY (ADA BDE/CMD)
SIGNAL OPERATIONS COMPANY (ADA GP)

- **Mission.** To provide signal communications support for an air defense artillery brigade/command headquarters and three to five assigned or attached ADA groups.
- **Assignment.** Organic to an air defense brigade/command.
- **Capabilities.** Provides on a 24-hour basis:
  - A multichannel communications system which provides telephone, teletypewriter and data channels to link together an ADA Bde/Comd Hq, 3 to 5 ADA Gp Hq, and 15 to 20 ADA Bns.
  - Command communications centers for an ADA Bde/Comd and three to five ADA Gps. Each center includes radio, telephone and teletypewriter facilities; and message center, off-line crypto, facsimile and motor messenger services.
- **Personnel.** Officers 37; Warrant Officers 8; Enlisted 911; Total 956.

HEADQUARTERS AND HEADQUARTERS DETACHMENT ADA SIGNAL OPERATIONS BATTALION, TOE 11-176



Mission. To plan, control, and coordinate operations and training of an ADA signal operations battalion. To provide administrative and logistical support for an ADA signal operations battalion.

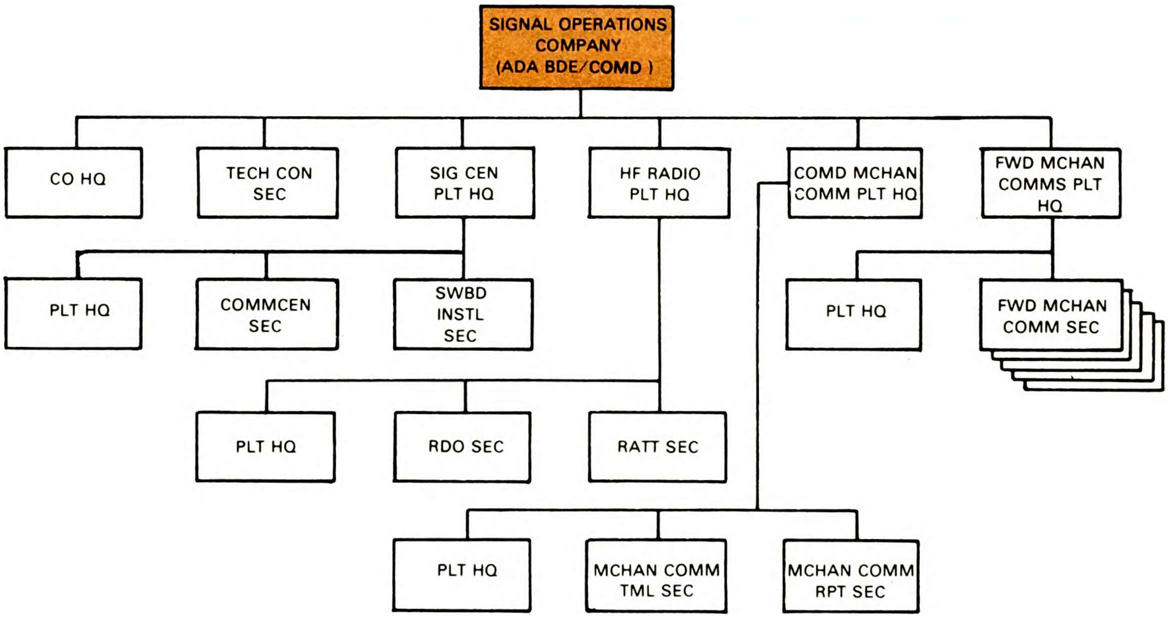
Assignment. Organic to an air defense artillery signal operations battalion, TOE 11-175.

Capabilities. Provides on a 24-hour basis:

- A low capacity, multichannel communications system and repeater facilities to provide telephone, teletype and data channels between an ADA Bde/Comd Hq and three to five assigned or attached ADA Gps to include lateral systems between groups.
- A Command communication center which includes:
  - A teletypewriter terminal facility.
  - Message center, off-line crypto, facsimile and motor messenger services.
  - A 100-line manual telephone center office and local telephone distribution system.
  - A radio-wire-integration (RWI) facility.
  - Two SSB-voice radio stations for operations in the ADA Bde Comd net.
  - Six radio teletype (RATT) stations for operation in the ADA Bde Comd RATT net which includes one for the Bde command post and one for each of the five ADA Gps.
  - Technical control and circuit patching facilities.
- FM radios for operation of the battalion command and SYSCON nets and to provide initial line-up for the multichannel communications system.

Personnel. Officers 11; Warrant Officers 2; Enlisted 60; Total 73.

AIR DEFENSE ARTILLERY SIGNAL OPERATIONS COMPANY (ADA BDE/CMD), TOE 11-177



Mission. To provide signal communications support for an ADA Bde/Comd Hq.

Assignment. Organic to an air defense artillery signal operations battalion, TOE 11-175.

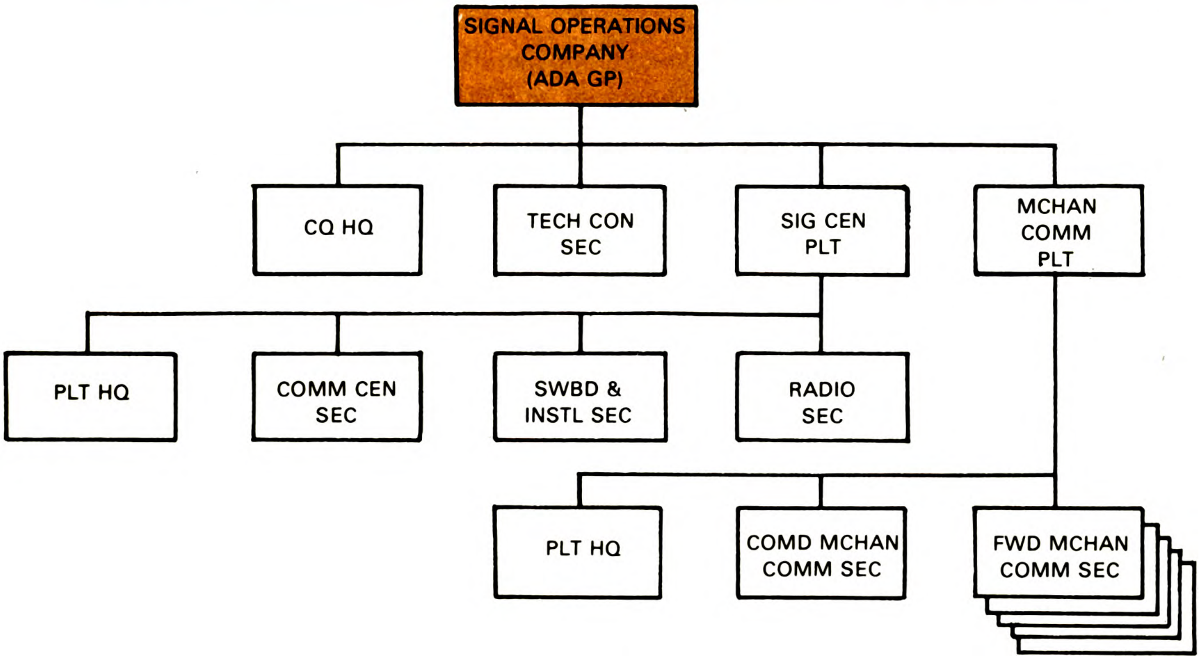
Capabilities. Provides on a 24-hour basis:

- A low capacity, multichannel communications system and repeater to provide telephone, teletype, and data channels between ADA Bde/Comd Hq and three to five assigned or attached ADA groups to include lateral systems between groups.
- A command communications center which includes:
  - A teletype terminal facility, message center, off-line crypto, facsimile and motor messenger services.
  - A technical control and circuit patching facility, a 100-line man telephone center office facility and a local telephone distribution system.
  - A radio-wire-integration (RWI) facility.
  - Two SSB-voice radio stations in the ADA Bde Comd net.
  - Six RATT stations in ADA Bde Comd RATT net which includes one station for the Bde CP and one for each of the five ADA Gps.

  - FM radios for operation of the battalion command and SYSCON nets and to provide lineup for the multichannel communications system.

- **Personnel.** Officers 6; Warrant Officers 1; Enlisted 186; Total 193.

AIR DEFENSE ARTILLERY SIGNAL OPERATIONS COMPANY (ADA GP), TOE 11-178.



- **Mission.** To provide signal communications support for an ADA group.

- **Assignment.** Normally organic to an ADA signal operation battalion, TOE 11-175. May be assigned to an ADA group in independent operations.

- **Capabilities.** Provides on a 24-hour basis:
  - A low capacity multichannel communications system and repeater capability to provide telephone, teletype, and data channels between an ADA Gp Hq and four assigned or attached ADA battalions, to include lateral systems between battalions.
  - A command communications center for an ADA Gp Hq which includes:
    - ☐ A teletypewriter terminal facility.

  - Message center, off-line crypto, facsimile and motor messenger services.
  - A 60-line manual telephone center office, technical and circuit control facilities.
  - A radio-wire-integration (RWI) facility.
  - Two SSB-voice radio stations for operation in the ADA Gp Comd RATT net.
- FM radios for operation of the battalion command and SYSCON net and to provide initial line-up for the multichannel communications system.

Personnel. Officers 4; Warrant Officers 1; Enlisted 133; Total 138

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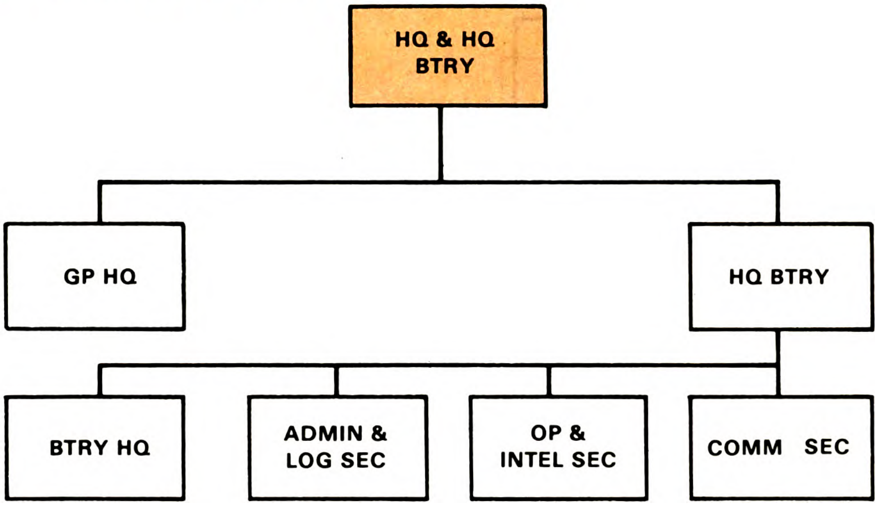
CHAPTER 9 ORGANIZATIONS - ABOVE BATTALION

9-1 GENERAL

The composition of ADA units above the battalion level is flexible and is determined by the requirements of a specific situation or mission.

9-2 AIR DEFENSE ARTILLERY GROUP—HEADQUARTERS AND HEADQUARTERS BATTERY, TOE 44-12



- **Mission.** To provide command, control, and administrative supervision of assigned or attached air defense artillery organizations and units employed in air defense operations.

- **Assignment.** Normally assigned to a corps, air defense artillery brigade, or an Army air defense command in a theater of operations.

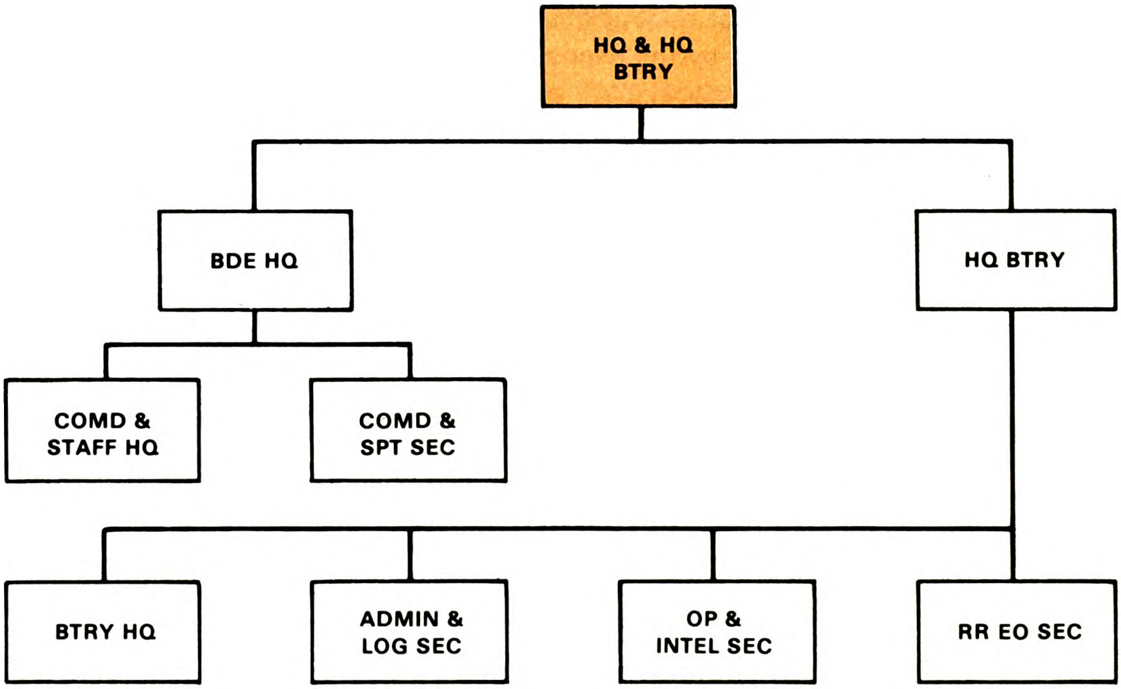
- **Capabilities.** Provides command, staff planning, and supervision of operations; supply administration, and organizational maintenance of all organic equipment except communications. Additional capabilities, when required for a specific deployment, may be added by augmentation. The following additional capabilities may be required: staff planning and supervision of the tactical and technical aspects of a group which is the senior air defense artillery headquarters in the area; management of airspace and air defense function at the tactical operations center of the major headquarters; liaison with other armed forces and allied forces as required; and operation of command and control system facilities.

- **Allocation.** One or more to a corps, air defense artillery brigade or Army air defense command, or major subordinate element of the Army component of a unified command.

- **Mobility.** One-hundred percent mobile.

Personnel Officers 20; Warrant Officers 2; Enlisted 52; Total 74

9-3 AIR DEFENSE ARTILLERY BRIGADE—HEADQUARTERS AND HEADQUARTERS BATTERY, TOE 44-2



- **Mission.** To plan, direct, and coordinate operations of subordinate air defense artillery groups and other units employed in air defense operations.

- **Assignment.** Normally assigned to a theater army, an Army air defense command, or other similar major headquarters within a theater of operation.

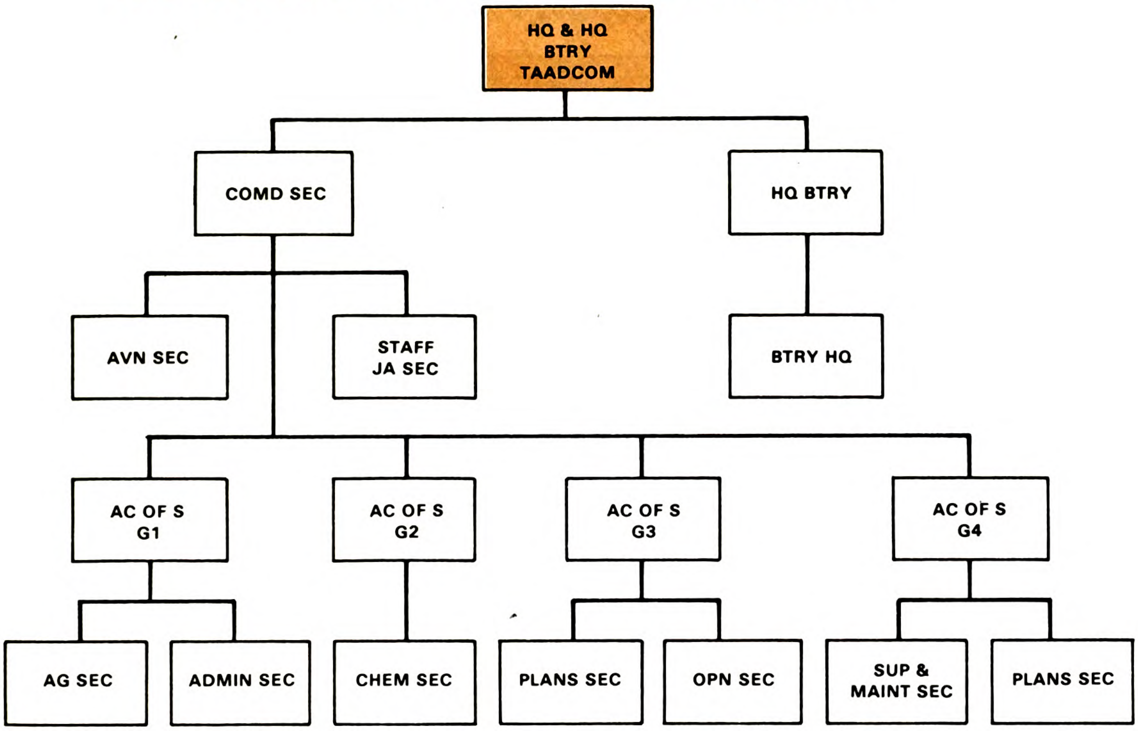
- **Capabilities.** Provides command, staff planning, and supervision of operations; supply, administration, and organizational maintenance of all organic equipment except communications. Additional capabilities, when required for specific deployment, may be added by augmentation.

- **Allocation.** One or more to a theater army, an Army air defense command,or other major headquarters within a unified command.

- **Mobility.** Seventy-five percent mobile in organic vehicles.

- **Personnel.** General Officer 1 (BG); Officers 23; Warrant Officers 2; Enlisted 51; Total 77.

9-4 THEATER ARMY AIR DEFENSE COMMAND—HEADQUARTERS AND HEADQUARTERS BATTERY, TOE 44-1H (DRAFT)



When warranted by the commitment of large forces, a theater army air defense command (TAADCOM) may be established to exercise command of Army air defense forces. If the force level is relatively small in a particular theater, an ADA brigade or group will perform this function.

■ **Mission.** To exercise command of Army air defense forces.

■ **Assignment.** Normally assigned to a theater army.

■ **Allocation.** One to a theater army in an oversea theater of operation.

■ **Capabilities.** The unit provides command, staff planning supervision of operations; supply, administration, and organizational maintenance of all organic equipment; air transportation for route and area reconnaissance, command staff visits, and emergency resupply of critical repair parts to subordinate air defense units; and liaison to the senior ground force and Air Force elements when augmented.

This unit is dependent upon appropriate elements of the theater army for personnel administration and finance services; for mess support when unit is augmented; for automotive maintenance support when unit is augmented; and for communication support.

■ **Personnel.** General Officers 2 (1-MG, 1-BG); Officers 44; Warrant Officers 2; Enlisted 86; Total 134

Table 9-1. Summary of Equipment, ADA Organizations.

NOMENCLATURE	ADA BN N/H TOE 44-535	ADA Bn I/H TOE 44-245	ADA Bn Herk-T TOE 44-235	ADA Bn I/H-Trd TOE 44-265	ADA Bn C/V SP TOE 44-325	AD Bn Chap (SP) Vul (T) TOE 44-725	ADA Bn Vul (T) Air Aslt Div TOE 44-425	ADA Bn Vul (T) ABN TOE 44-425	ADA Bn AW SP TOE 44-85	ADA Group TOE 44-12	ADA Bde TOE 44-2	Theater ADCOM TOE 44-1H (Draft)
ELECTRONICS												
Radiac Set, AN/PDR-27	5	11	11	6	5	6	5	6	5	1	1	1
Radiac Set, AN/PDR-60	0	0	0	0	0	0	0	0	0	0	0	1
Radiac Meter, IM-93/UD	30	43	25	36	72	81	55	45	26	2	2	2
Radiac Meter, IM-174/PD	15	25	18	24	51	52	31	26	13	1	1	1
Radio Set, AN/GRC-106	12	24	13	23	2	2	5	8	23	2	0	2
Radio Set, AN/GRC-160	12	1	0	0	21	10	48	0	0	0	0	0
Radio Set, AN/PRC-77	0	8	0	9	6	6	0	22	0	0	0	0
Radio Set, AN/PRC-90	0	0	0	0	0	0	0	0	0	0	0	0
Radio Set, AN/VRC-44	0	0	0	0	0	8	0	0	0	0	0	0
Radio Set, AN/VRC-46	42	22	7	19	48	27	30	44	71	1	1	0
Radio Set, AN/VRC-47	10	14	16	11	49	52	9	68	17	2	2	0
Radio Set, AN/VRC-48	0	0	0	0	20	22	16	0	0	0	0	0
Radio Set, AN/VRC-49	0	1	0	1	2	0	1	1	0	0	0	0
Radio Set Control Group, AN/GRA-39	34	21	12	19	65	65	29	77	17	2	2	0
Radio Terminal Set, AN/TRC-145	6	7	6	5	0	0	0	0	0	0	0	0
Radio Teletypewriter Set, AN/VSC-2	0	0	0	0	0	0	2	2	0	0	0	0
Radio Teletypewriter Set, AN/GRC-122	1	1	1	0	0	1	0	0	0	0	0	0
Radio Teletypewriter Set, AN/GRC-142	0	0	0	1	2	0	0	0	1	0	0	0
TADDS (Display Set, Target Alert Data)	0	0	0	0	60	60	0	60	0	0	0	0
Receiver/Transmitter Control Group, AN/GRA-6	12	23	4	23	1	1	5	8	0	2	0	2
TACTICAL VEHICLES												
Trailer, Cargo, ¼-Ton, 2-Wheel, W/E	28	24	22	16	39	34	31	49	31	9	7	0
Trailer, Cargo, ¾-Ton, 2-Wheel, W/E	15	22	22	24	28	21	35	42	17	0	0	1
Trailer, Cargo, 1½-Ton, 2-Wheel, W/E	27	25	18	25	34	33	2	1	30	1	1	0
Trailer, Tank, Water, 400-Gal, 1½-Ton, W/E	5	5	5	4	5	5	1	5	5	1	1	1
Truck, Ambulance, ¼-Ton, 4X4, W/E	0	0	0	0	0	0	1	1	1	0	0	0
Truck, Ambulance, 1¼-Ton, 4X2	0	1	0	0	0	1	0	0	0	0	0	0
Truck, Ambulance, 1¼-Ton, 4X4, W/E	1	1	1	1	1	1	0	0	1	0	0	0
Truck, Cargo, ¾-Ton, 4X4, W/E	0	0	0	0	0	0	0	0	0	0	0	0
Truck, Cargo, 2½-Ton, 6X6, W/E	24	53	60	42	26	30	1	5	32	2	2	1
Truck, Cargo, 2½-Ton, 6X6, W/Winch, W/E	15	0	0	0	0	2	2	5	5	1	1	0
Truck, Cargo, 2½-Ton, 6X6, XLWB, W/E	2	66	43	65	2	2	0	0	0	0	0	0
Truck, Cargo, 2½-Ton, 6X6, XLWB, W/Winch, W/E	0	0	24	0	0	0	0	0	0	0	0	0
Truck, Cargo, 5-Ton, 6X6, LWB, W/E	48	14	6	17	12	7	0	0	4	0	0	0
Truck, Tractor, 5-Ton, 6X6, W/E	6	12	9	10	0	0	0	0	0	0	0	0
Truck, Utility, ¼-Ton, 4X4, W/E	40	24	22	16	39	34	31	49	31	9	7	0
Truck, Wrecker, 5-Ton, 6X6, W/Winch, W/E	2	6	6	5	1	3	1	1	1	0	0	0
Truck, Van, Expansible, 4X4	0	2	0	0	0	0	0	0	0	0	0	0
Truck, Cargo, 1¼-Ton, 4X4, W/E	39	33	34	38	32	53	91	91	17	0	0	1
Truck, Cargo, 5-Ton, Dropside, 6X6, W/E	0	2	0	3	0	0	0	0	0	0	0	0
Truck, Cargo, 5-Ton, 6X6, LWB, W/Winch, W/E	0	12	0	3	5	0	0	0	9	0	0	0
Truck, Cargo, 5-Ton, 6X6, XLWB, W/E	0	4	0	9	0	0	0	0	0	0	0	0
Truck, Cargo, 5-Ton, 6X6, XLWB, W/Winch, W/E	0	4	0	6	0	0	0	0	0	0	0	0
Truck, Cargo, 5-Ton, 8X8, W/E	0	0	0	0	0	0	0	0	0	0	0	0
INDIVIDUAL AND CREW-SERVED WEAPONS												
Launcher, Grenade, 40-mm: Sgle Shot, Mtd, Dtchbl, W/E	41	24	24	35	45	68	64	0	0	1	1	0
Machinegun, 7.62-mm: Light Flexible	34	24	29	38	20	20	20	20	13	2	2	0
Rifle, 5.56-mm, W/E	921	861	761	738	574	548	523	542	678	64	64	103
Pistol, Caliber .45, Automatic	29	13	13	17	22	25	14	14	15	9	11	28
Launcher, Grenade, M203	0	0	0	0	0	0	0	0	0	0	0	0
Machinegun, Caliber .50	0	20	0	0	20	10	0	0	1	0	0	0
Launcher, Grenade, 40-mm	0	0	0	0	0	0	0	0	0	0	0	0
Machinegun, Caliber .30	0	0	0	0	0	0	0	64	64	0	0	0

USER NOTE: Table does not include primary weapon systems and their major components.

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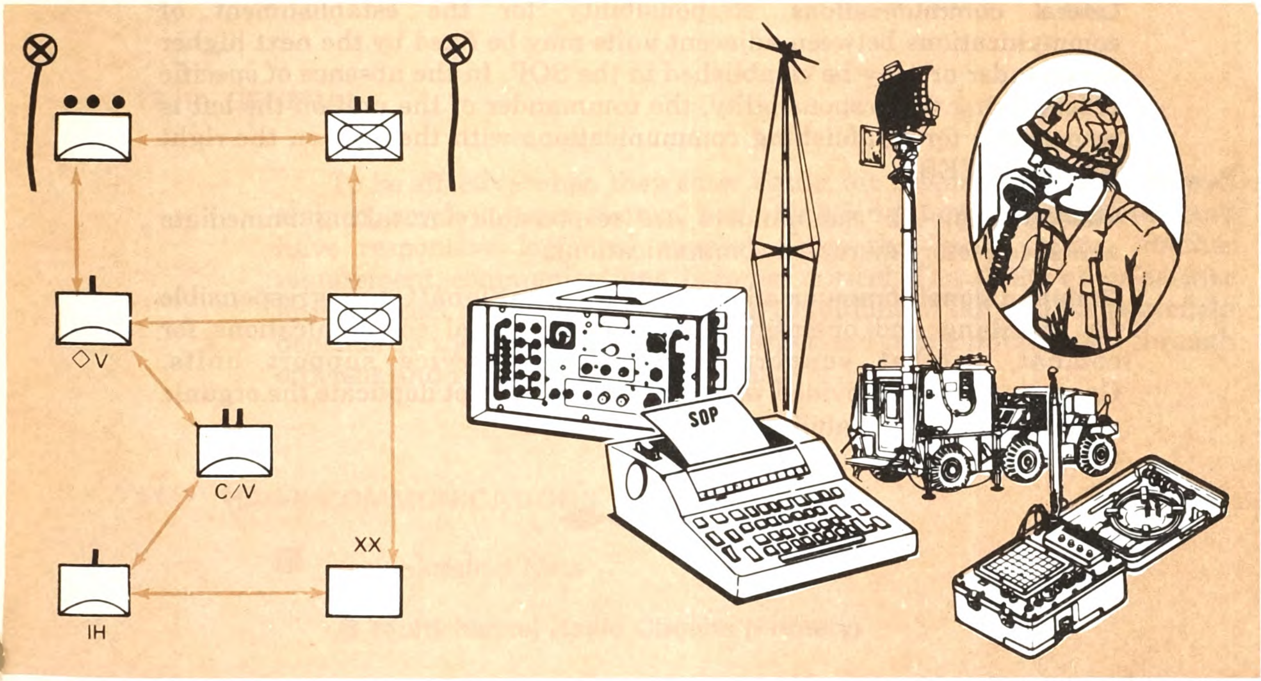
CHAPTER 10 COMMUNICATIONS DOCTRINE



10-1 GENERAL

For maximum effectiveness, air defense weapon systems require the command and control made possible by the use of communications especially tailored for air defense needs. Loss or impairment of the vital communications links between control facilities and units materially reduces the efficiency and capability of air defense.

10-2 COMMUNICATIONS RESPONSIBILITIES

The commander is personally responsible for the adequacy and proper use of the communications system within his command and for its efficient operation with the systems of the next higher headquarters.

10-3 PRINCIPLES OF COMMUNICATIONS

Senior to subordinate. The commander of a higher echelon, or superior unit, is responsible for the establishment of communications with a lower echelon, or a subordinate unit.

Supporting to supported. The commander of a supporting unit is responsible for the establishment of communications with the supported unit.

Reinforcing to reinforced. A unit having a reinforcing mission is responsible for the establishment of communications with the unit being reinforced.

Lateral communications. Responsibility for the establishment of communications between adjacent units may be fixed by the next higher commander or may be established in the SOP. In the absence of specific orders fixing the responsibility, the commander of the unit on the left is responsible for establishing communications with the unit on the right facing the FEBA.

Maintenance. All commanders are responsible for taking immediate action to restore disrupted communications.

Common signal communications support. The Signal Corps is responsible for installing and operating common-user signal communications for combat, combat support, and combat service support units. Communications provided will complement, but not duplicate,the organic communications capability of supported units.

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CHAPTER 11 ADA COMMUNICATIONS NETS

11-1 GENERAL

To be effective when they enter battle, air defense units must be well trained, employ proper tactics, have functional tactical equipment, and have responsive logistical support. Once the battle begins, another requirement, communications, becomes critical. The ability of air defense units to react to the rapidly changing conditions of the modern battlefield depends on the receipt of real-time target and battle information through efficient and reliable communications.

11-2 HAWK COMMUNICATIONS

Intrabattalion Nets

- **Multichannel Radio Circuits (Primary)**

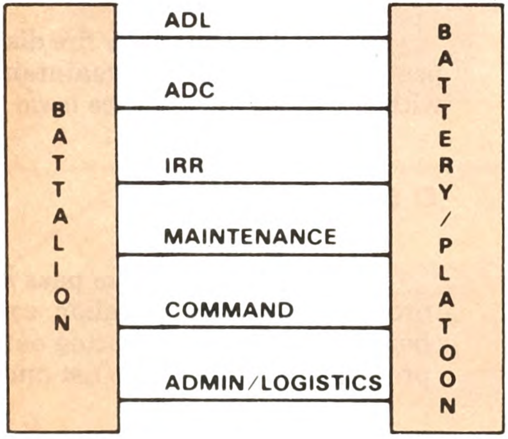

Figure 11-1. Multichannel Circuits (Primary).

The multichannel system provides the principal means of communication in the battalion. Single channel HF/SSB and FM radio nets provide alternate methods of communication when the multichannel circuits malfunction.

These circuits or nets function as follows:

☐ **Automatic Data Link (ADL)**

This circuit is used to pass digital real-time air battle information such as track information,engage commands, unit engagement status, and firing status among higher level control facilities, battalion operation centers, batteries, and platoons. There is no backup for this circuit.

☐ **Air Defense Command (ADC)**

This net provides for the voice exchange of tactical information not capable of being transmitted by ADL. It also serves as the primary air battle control circuit when the ADL is nonoperational or when operating in the manual mode.

☐ **Intelligence Radar Reporting (IRR)**

This circuit is used to pass air defense intelligence information, primarily early warning. Though the circuit is capable of two-way voice, it is normally used as a one-way higher-to-lower circuit. An HF/SSB IRR net provides backup.

☐ **Maintenance**

This circuit is used by fire distribution and communications personnel to aline and maintain the fire distribution system within the battalion. There is no backup net for this circuit.

☐ **Command**

This circuit is used to pass air battle command and control orders among the battalion commander, battalion staff, and battery commanders. During outages or moves, an FM radio net provides backup for this net and the admin/log net.

☐ **Administrative/Logistics (Admin/Log)**

This circuit is used to pass routine administrative and logistical information (e.g., status of and requests for spare parts, ammunition, rations,etc.). During outages and moves, an FM net provides backup.

■ Single Channel Radio Nets (Backup)

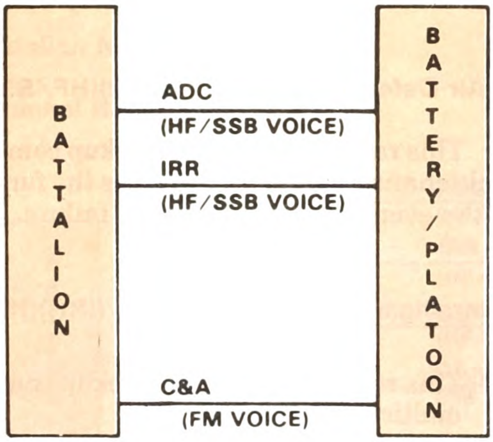

Figure 11-2. Single Channel Nets (Backup).

☐ Command and Administrative/Logistics (C&A)(FM)

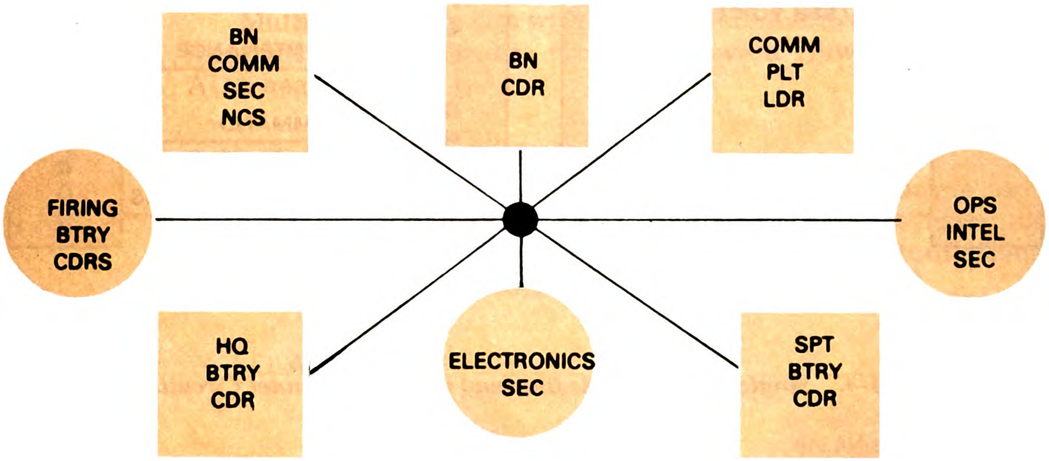

Figure 11-3. Battalion C&M (FM) Net.

This net, mentioned previously, is used as a backup for command and admin/log multichannel circuits. It is also used for command and control (other than air battle traffic) when batteries are displacing.

☐ Air Defense Command (ADC)(HF/SSB)

This radio net provides backup communications for the ADC multichannel circuit. It assumes the functions of the ADC circuit in the event of a multichannel failure.

☐ Intelligence Radar Reporting (IRR)(HF/SSB)

This radio net provides backup communications for the IRR multichannel circuit.

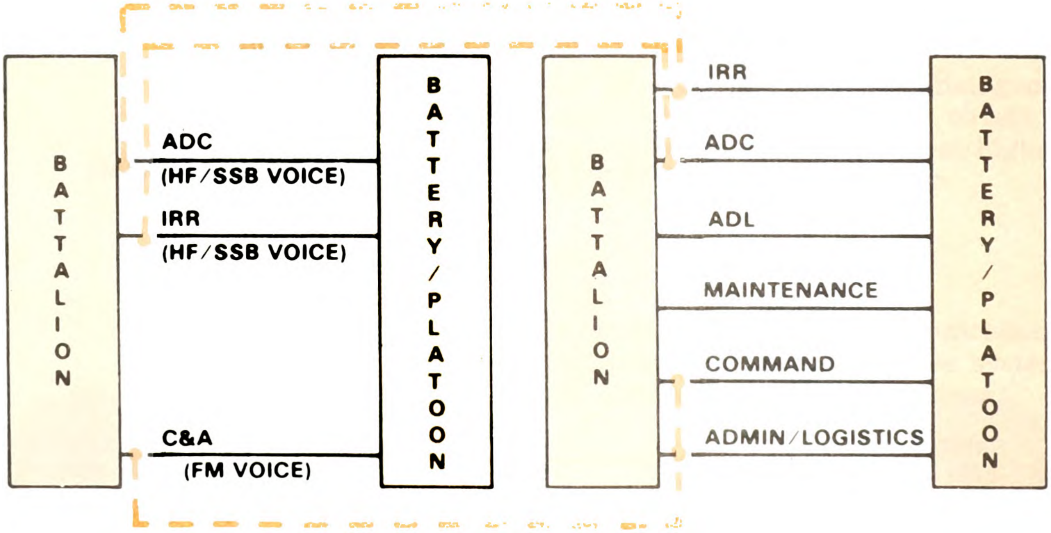

Figure 11-4. Single Channel Nets (Backup) and Multichannel Circuits (Primary).

■ Wire Nets

Wire is the primary means used within the battalion headquarters to pass both operational and administrative information. Wire is also used to establish an administration and local security net.

External Battalion Nets

Multichannel Radio Nets

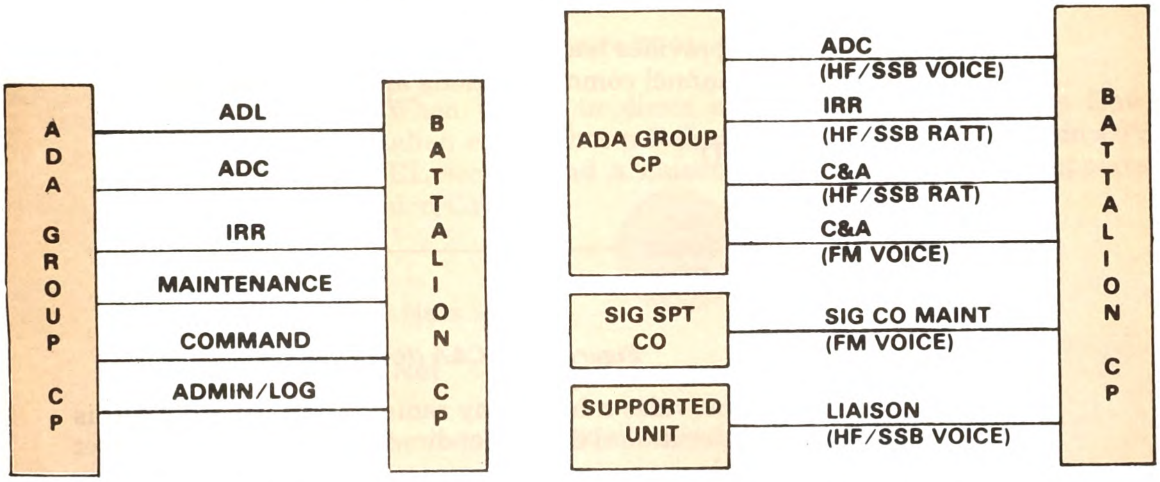

Figure 11-5. Multichannel Radio Circuits and FM and HF/SSB Radio Nets.

Multichannel circuits with functions similar to those discussed in intrabattalion circuits are provided between Hawk battalions and ADA headquarters

Single Channel Radio Nets

There are HF/SSB and FM radio nets used as backup for the multichannel circuits. Also two additional nets are external to battalion, the Signal Company maintenance net and battalion liaison net. Normally the following radio nets are established:

☐ **ADC**

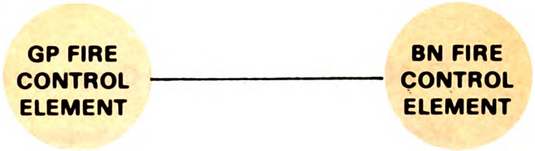

Figure 11-6. ADC Net.

This net provides alternate communications for control of the air battle when multichannel communications are not operational.

☐ IRR

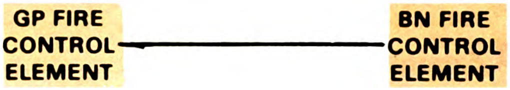

Figure 11-7. IRR Net.

This net provides backup communication for early warning when multichannel communications are not operational.

☐ C&A (RATT)

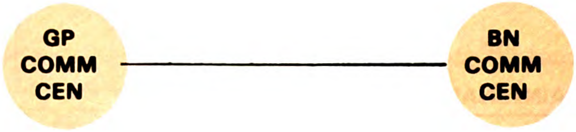

Figure 11-8. C&A (RATT) Net.

This net provides a hard-copy radioteletype capability. It is used to pass operational traffic not directly related to the conduct of the air battle.

☐ C&A (FM)

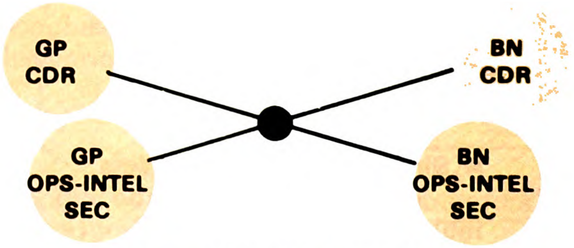

Figure 11-9. C&A (FM) Net.

This net allows the exchange of operational traffic between group and battalion commanders and their operations and intelligence (OPS-INTEL) sections.

☐ ADA Signal Support Company Maintenance

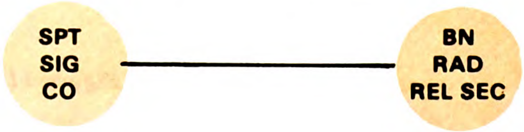

Figure 11-10. ADA Signal Support Company Maint Net.

The battalion radio relay section operates in the FM maintenance net of the supporting ADA signal company. The net is used for alinement and adjustment of the multichannel system.

Battalion Liaison

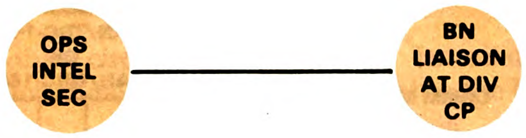

Figure 11-11. Liaison Net.

When placed in direct support of a division, the Hawk battalion establishes a liaison net between the battalion OPS-INTEL section and a liaison officer located in the supported division CP.

Intrabattery Nets

Radio Net

Command and Administration Net (FM)

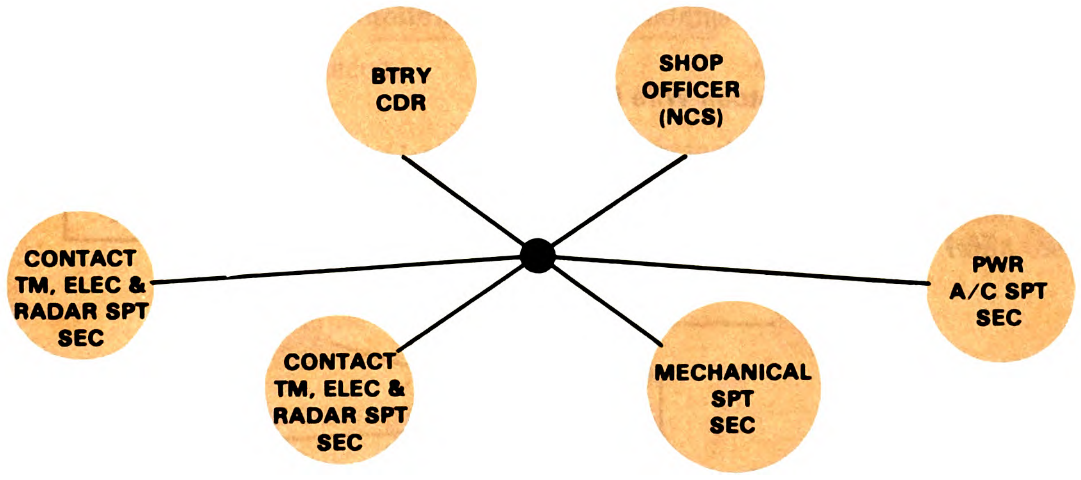

Figure 11-12. Command and Administration Net (FM).

This net provides communications between the battery and deployed platoons. It becomes the principal method of control between the battalion operation center and deployed platoons when the battery moves. When organic Redeye teams are deployed, they use this net as their primary link to the battery.

Wire Nets

Battery Wire Nets

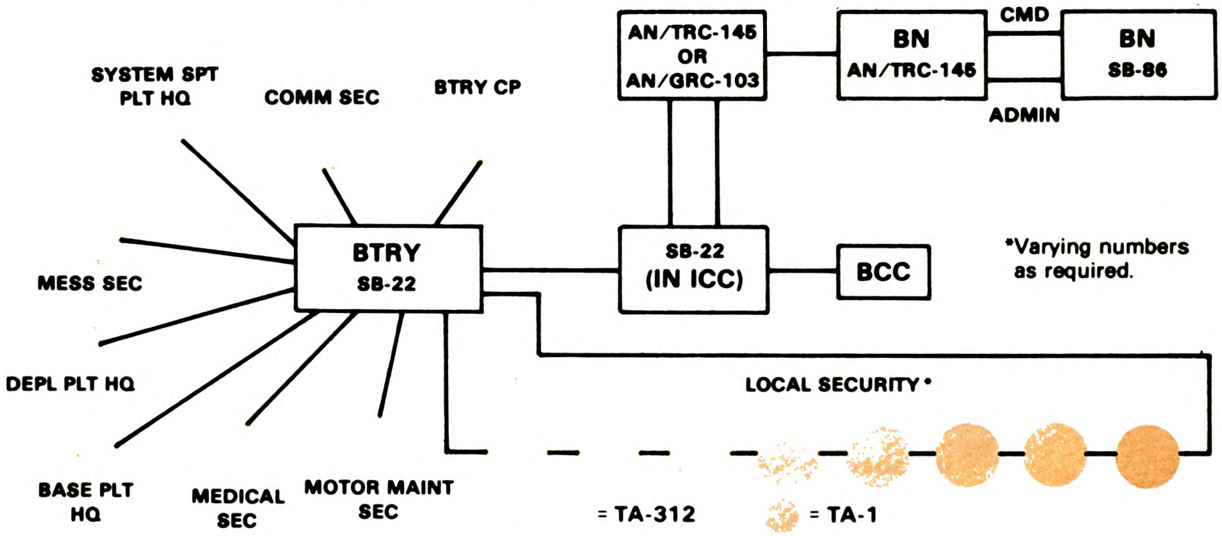

Figure 11-13. Typical Battery Wire Net.

Wire is the primary means used to pass operational and administrative information throughout the battery. It is also used to establish an administration/local security net.

Platoon Wire Net

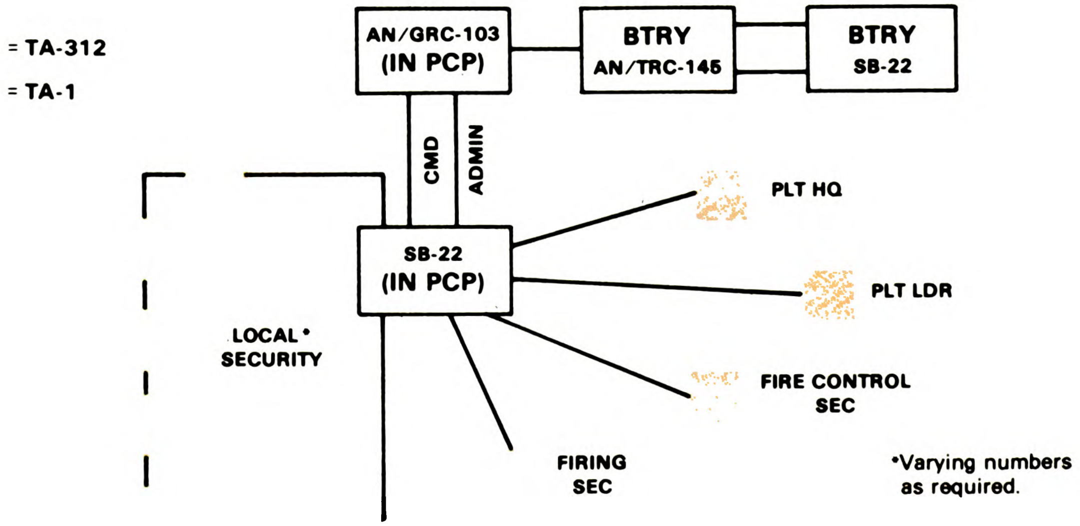

Figure 11-14. Typical Platoon Wire Net.

When separated from the battery, a firing platoon must establish an administration/local security wire net.

External Battery Nets

Multichannel Nets (Primary)

The multichannel circuits discussed under "Intrabattalion Nets" are the same multichannel nets that are external to the battery.

Radio Nets (Backup)

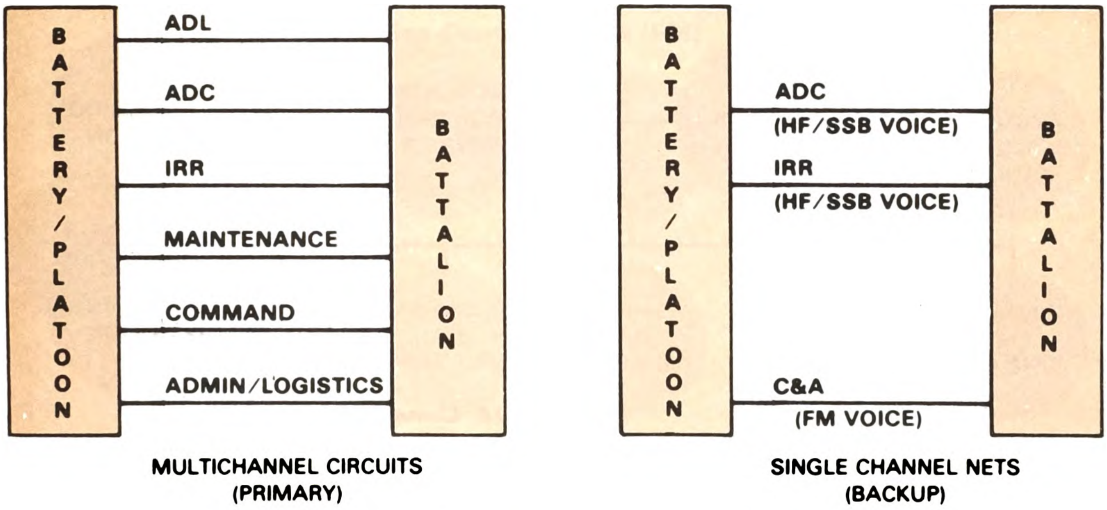

Figure 11-15. External Multichannel & Radio Nets.

The radio nets and their functions listed under "Intrabattalion Nets, Single Channel Radio Nets (Backup)", are the same radio nets indicated under this heading.

11-3 NIKE HERCULES COMMUNICATIONS

Battalion Nets

Nike Hercules internal and external nets are the same as those found in Hawk.

Battery Nets

External

Nike Hercules battery external nets are the same as those found in Hawk.

Internal

Nike Hercules battery internal nets are the same as those found in Hawk with the following exceptions:

Command Hot Loop

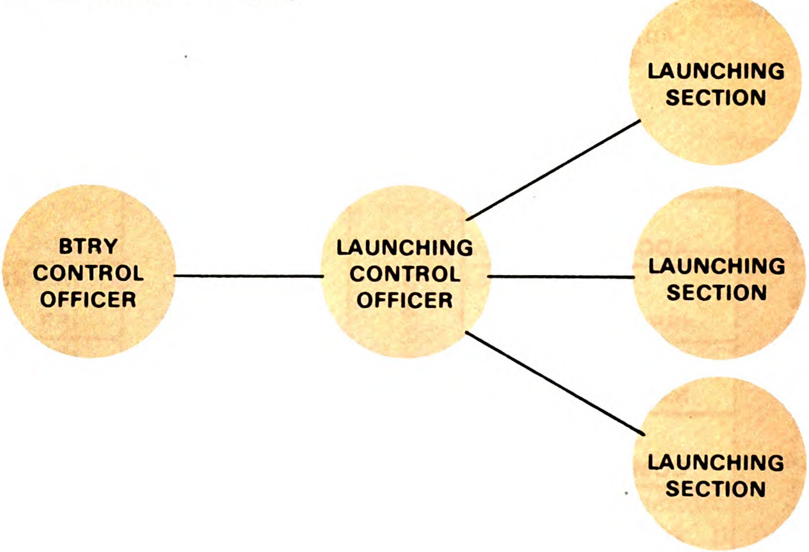

Figure 11-16. Command Hot Loop.

This net provides communications between the director station and the launcher control trailer, and is used to pass air battle information and launching instructions. This net can be FM radio, AM radio, or microwave.

Technical Hot Loop

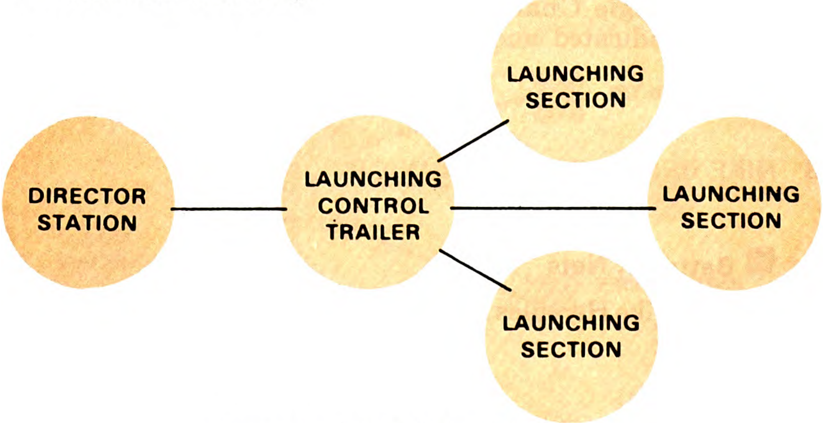

Figure 11-17. Technical Hot Loop.

This net provides for the exchange of information of a technical nature between the director station, launching control trailer, and launching sections. This net can be FM radio, AM radio, or microwave.

11-4 CHAPARRAL/VULCAN COMMUNICATIONS

Radio is the principal means of communications for both divisional and non-divisional Chaparral/Vulcan (C/V) battalions operating in a combat area. The nets shown are typical and can be supported by TOE authorized equipment. The exact composition of communications nets are dictated by mission, special circumstances, and the desires of division and battalion commanders.

■ Chaparral/Vulcan Battalion Nets

■ Internal Radio Nets

☐ Battalion Command Net (FM)

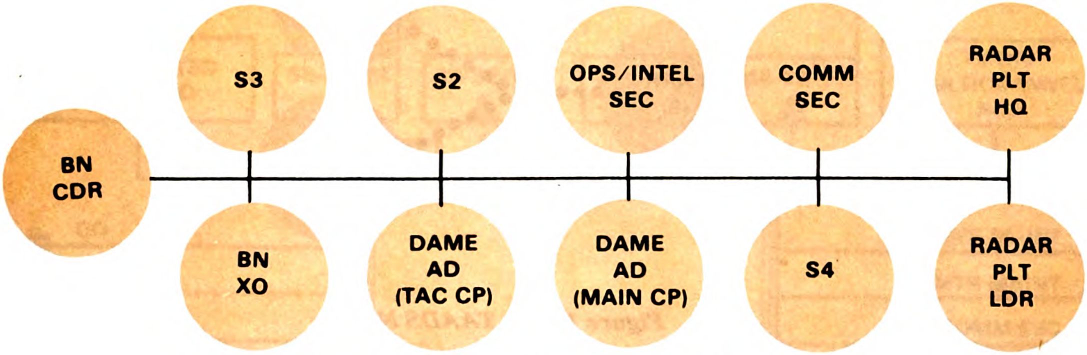

Figure 11-18. Battalion Command Net (FM).

The battalion commander, battalion staff, airspace management element (AME), and battery commanders operate in this net.

☐ Air Defense Liaison Net (SSB-Voice).

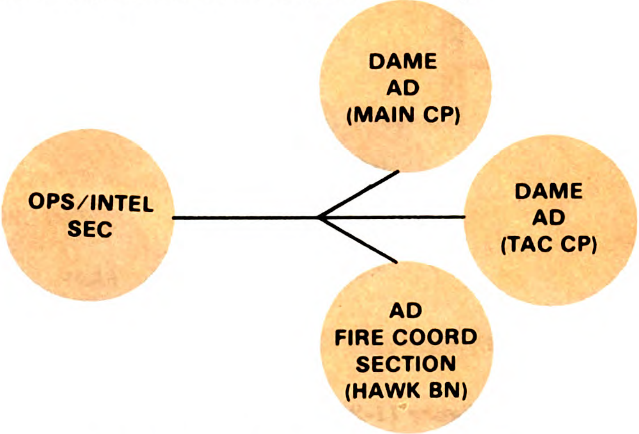

Figure 11-19. Air Defense Liaison Net.

This net is used to exchange air defense operational and intelligence information between the battalion headquarters and the nearest air defense artillery group or Hawk battalion. The airspace management element also operates in this net.

☐ **Target Alert Data Display Set (TADDS).**

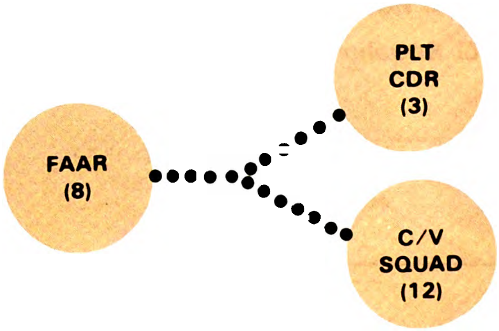

Figure 11-20. TAADS Net.

This one-way digital link connects the forward area alerting radar (FAAR) platoon sections to the Chaparral, Vulcan, and Redeye squads and teams.

☐ **Radar Platoon Command Net (FM).**

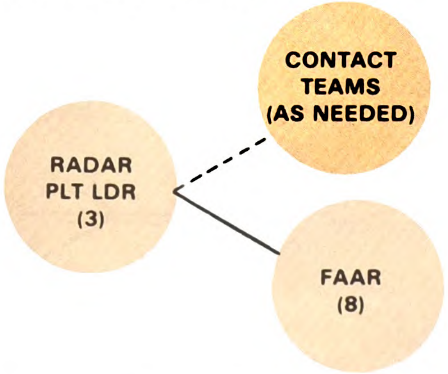

Figure 11-21. Radar Platoon Command Net (FM).

The forward area alerting radar (FAAR), contact teams, and radar platoon leader operate in this net.

■ Wire Nets

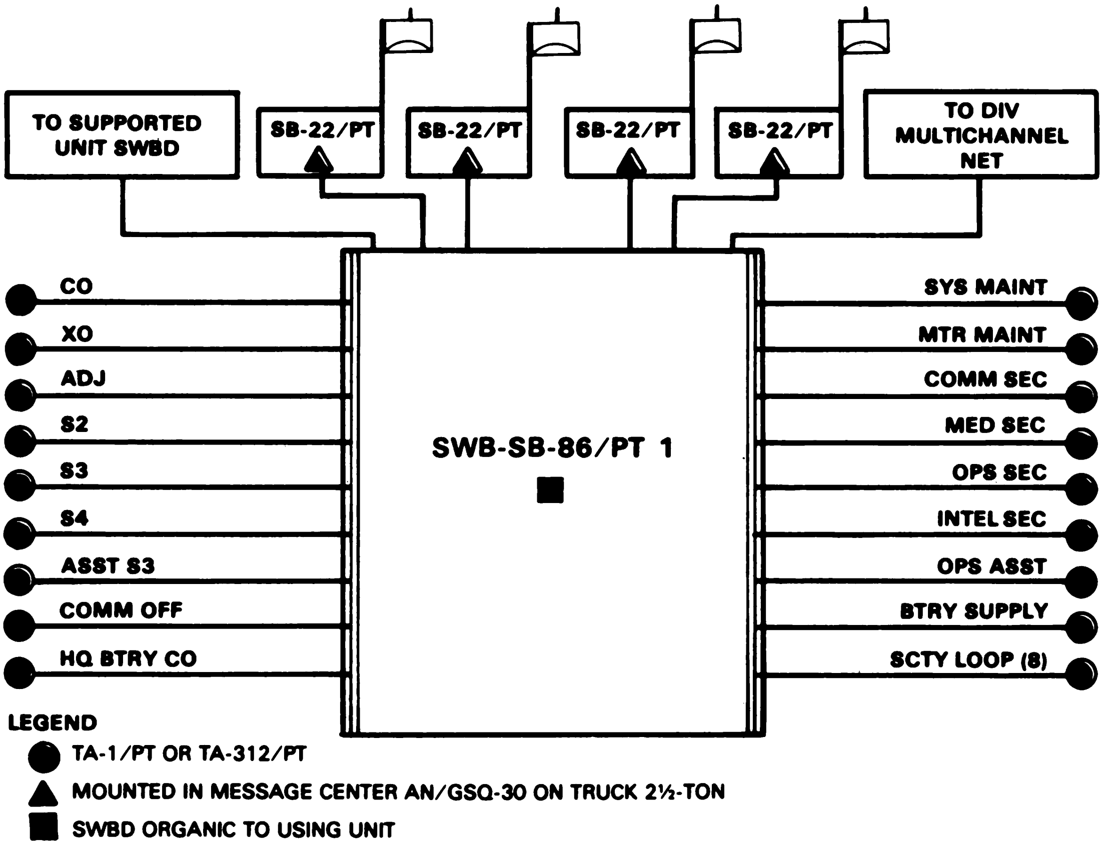

Figure 11-22. Type Wire System Divisional Chaparral/Vulcan Battalion.

The battalion communications section normally installs wire throughout the battalion headquarters and to other battalion agencies and units, as practical.

External Battalion Nets

Radio

☐ Division Command Net (FM)

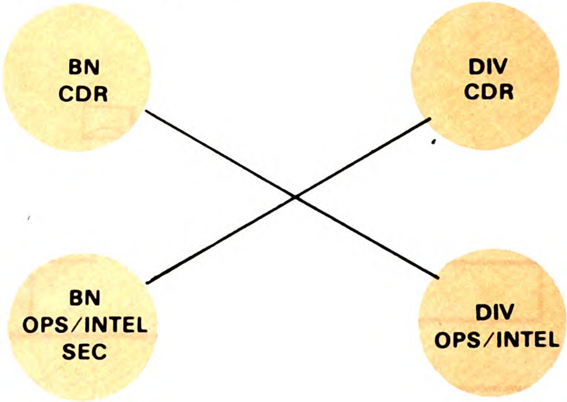

Figure 11-23. Division Command Net.

The communications section operates a station in the division command net (FM). The air defense artillery Chaparral/Vulcan commander's vehicle is equipped to operate in this net.

☐ Division TOC Net (SSB-Voice).

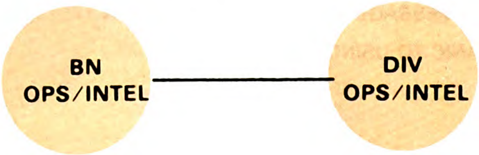

Figure 11-24. Division TVC Net (SSB).

The operations and intelligence section of the battalion headquarters operates in this net. The net is used to transmit air alerts and similar information of an urgent operational nature to the division.

☐ Division TOC Net (FM)

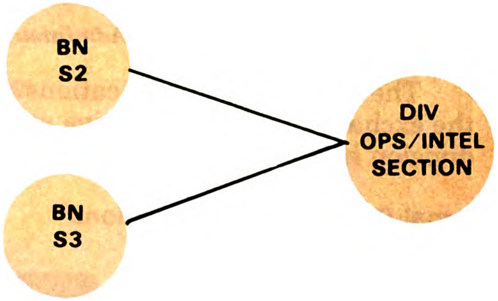

Figure 11-25. Division TOC Net (FM).

This net is usually monitored by the S3 and/or S2. It is primarily used for the exchange of intelligence information.

☐ Supported Unit Command Net (FM).

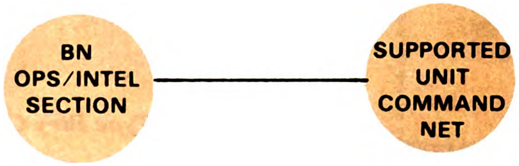

Figure 11-26. Supported Unit Command Net (FM)

The battalion OPS/INTEL section is equipped to monitor the command nets of supported units.

☐ Division Operations/Intelligence Net (RATT-AM).

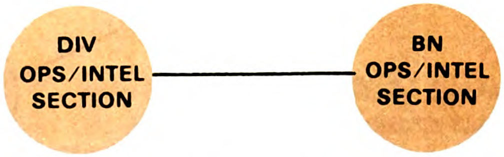

Figure 11-27. Division Operation/Intelligence Net (RATT-AM).

The battalion operations and intelligence section operates in this net.

☐ Division Administration Net (RATT-AM).

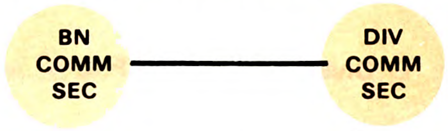

Figure 11-28. Division Administration Net (RATT-AM).

The battalion communications section operates in this net for the exchange of administrative and logistical information with division headquarters.

🟧 Internal Battery Communications

■ Radio Nets

☐ Battery Command Net (FM)

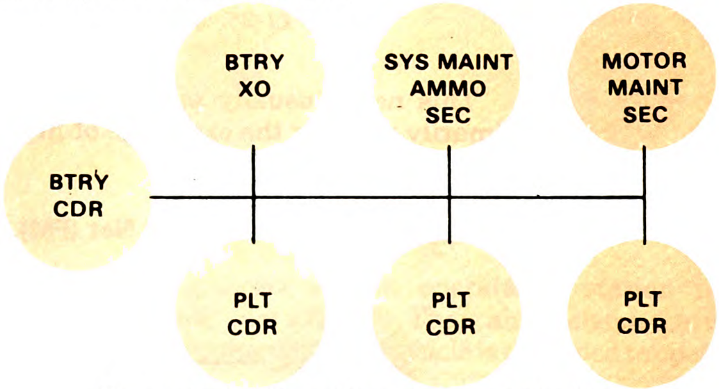

Figure 11-29. Type Btry Command Net (FM).

This net includes the battery commander, executive officer, platoon leader, and other elements, as directed.

☐ Platoon Command Net (FM)

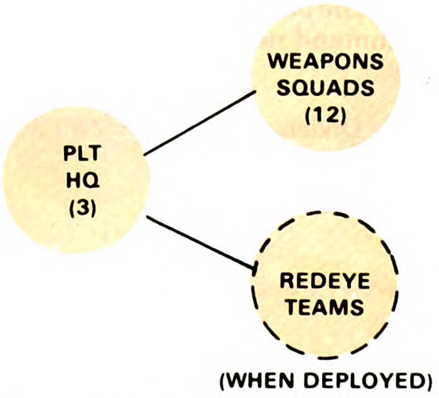

Figure 11-30. Platoon Command Net (FM).

This net includes the platoon headquarters, each weapons squad, and, when deployed, self-defense Redeye teams.

■ Wire Nets

Often the tactical situation prevents the use of wire nets. However, wire communications are established and used whenever possible.

☐ Battery

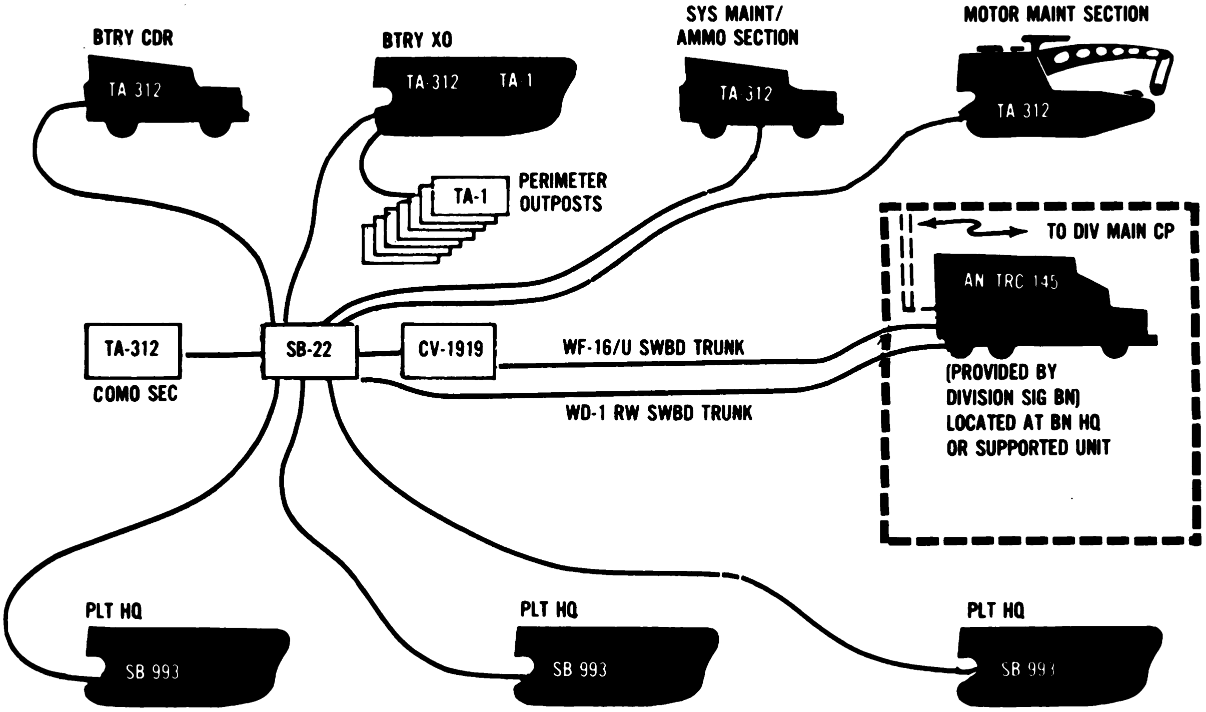

Figure 11-31. Division C/V Battalion - Type Chaparral/Vulcan Battery Wire Net.

Each C/V battery will establish intrabattery CP communications. In addition, wire communications may be established between the battery and-

- **One or more of the platoons.**
- **The battalion TOC.**
- **Supported or adjacent units.**

☐ Platoon

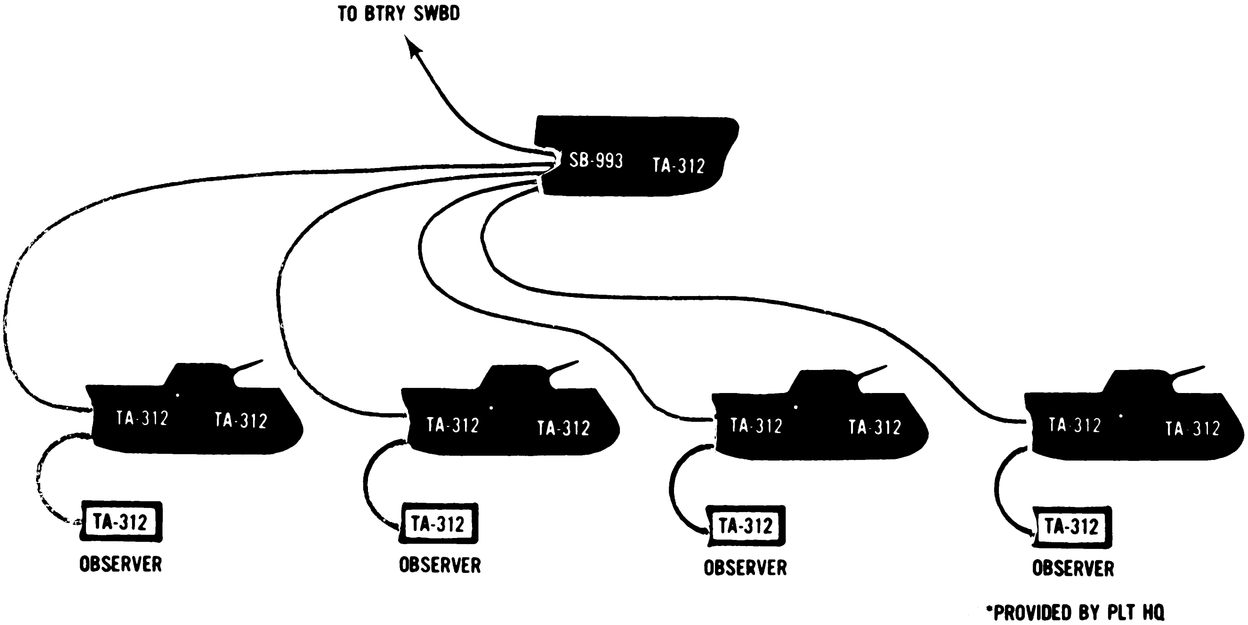

Figure 11-32. Type Vulcan Platoon Wire Net.

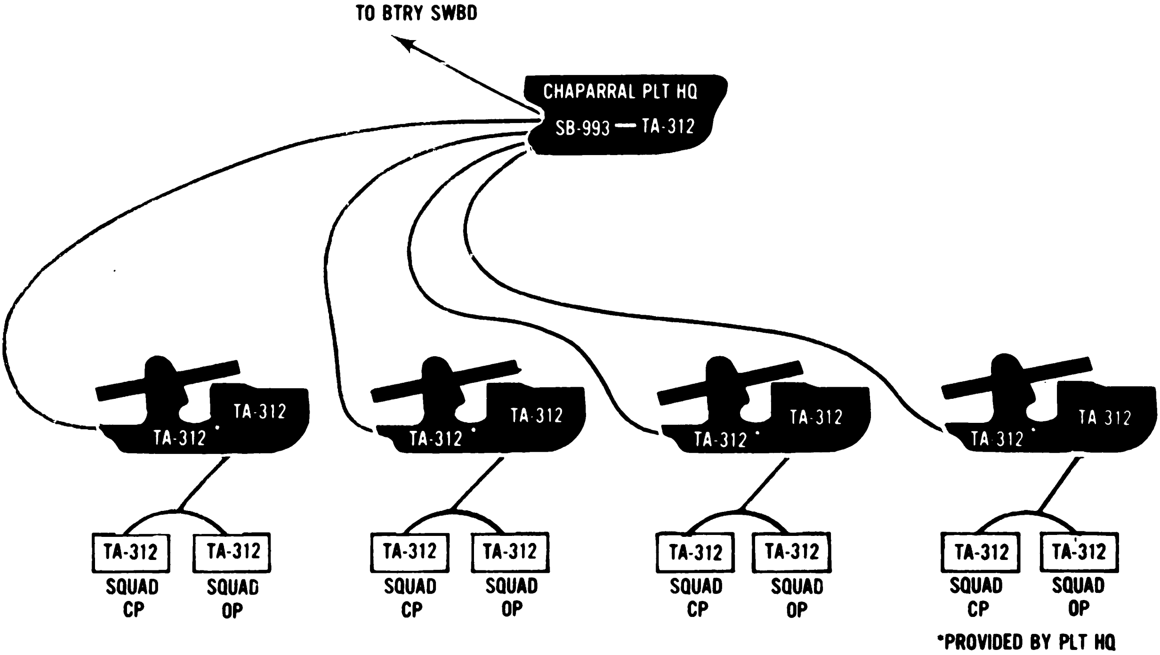

Figure 11-33. Type Chaparral Platoon Wire Net.

Platoon wire nets may be established between each platoon and the—

- **Battery CP.**
- **Supported unit.**

Squad

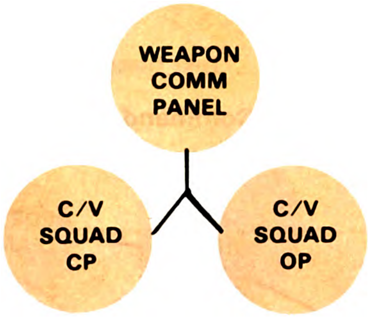

Figure 11-34. Type C/V Squad Wire Net.

Weapon squads normally lay wire to squad command and observation posts. In addition, wire lines may be established between the squad and—

- **The platoon command post.**
- **Adjacent squads.**
- **The supported unit.**

External Nets

Radio Nets

Battalion Command Net (FM).

Battery commanders operate in this net.

Target Alert Data Display Net (TADDS).

Each weapon squad and platoon headquarters monitor this one-way digital net using the TADDS receiver.

Supported Unit Command Net (FM)

Each weapon squad and each platoon and battery headquarters has the capability to monitor and, if necessary enter the supported unit command net.

11-5 REDEYE SECTION COMMUNICATIONS NETS

🟧 Internal Nets

■ Radio Net

☐ Redeye Command Net

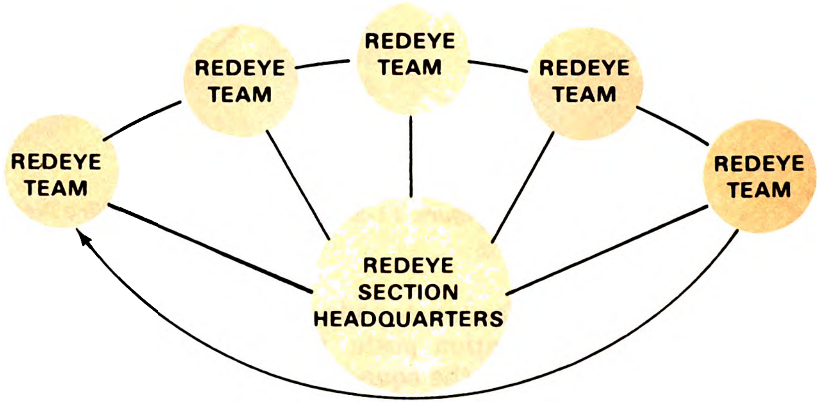

Figure 11-35. Redeye Command Net.

This net provides a two-way voice link between the section and the teams, and is used for the exchange of command and administrative information.

■ Wire Net

☐ Section

The extent to which wire communications are installed is governed by the tactical situation. When possible the section ties in with the supported unit wire system.

☐ Teams

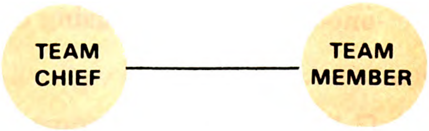

Figure 11-36. Team Wire Net.

Members of split teams use wire to communicate with each other.

External Radio Nets

Supported Unit Command Net

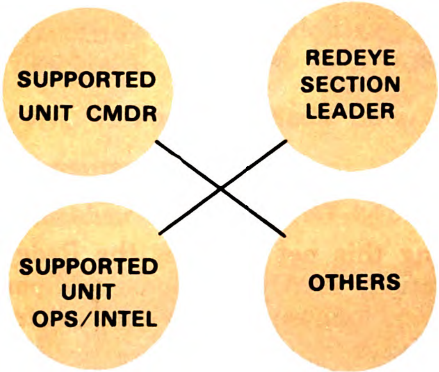

Figure 11-37. Supported Unit Command Net.

This net provides the section with information concerning the tactical situation.

Vulcan Platoon Net

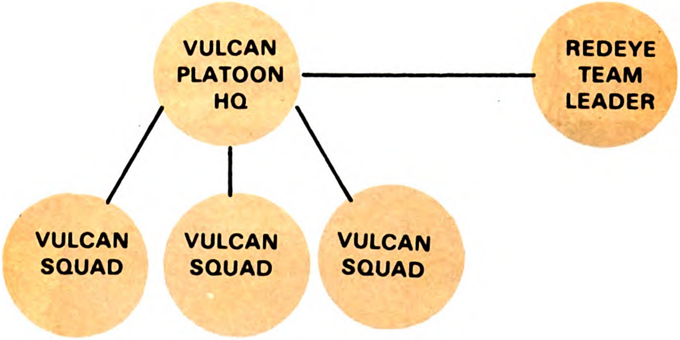

Figure 11-38. Vulcan Platoon Net.

This net is used when a Vulcan platoon and Redeye are supporting the same company team. Early warning, weapons control, AD warnings, alert status, and other information are passed over this net.

- **Division C/V battalion command Net.**

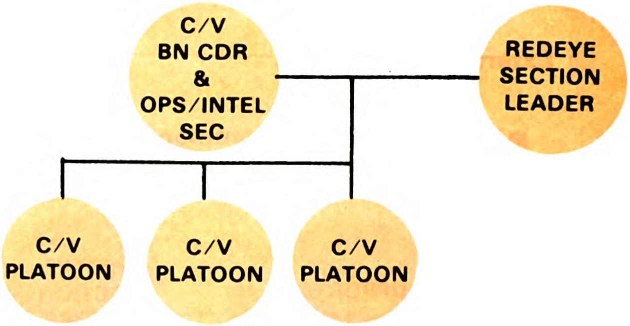

Figure 11-39. Division C/V BN Command Net.

Monitoring this net provides the Redeye section with the air defense situation, FAAR locations, weapons control orders and information, and long-range early warning from Hawk units and/or Air Force facilities.

- **FAAR/TADDS Net**

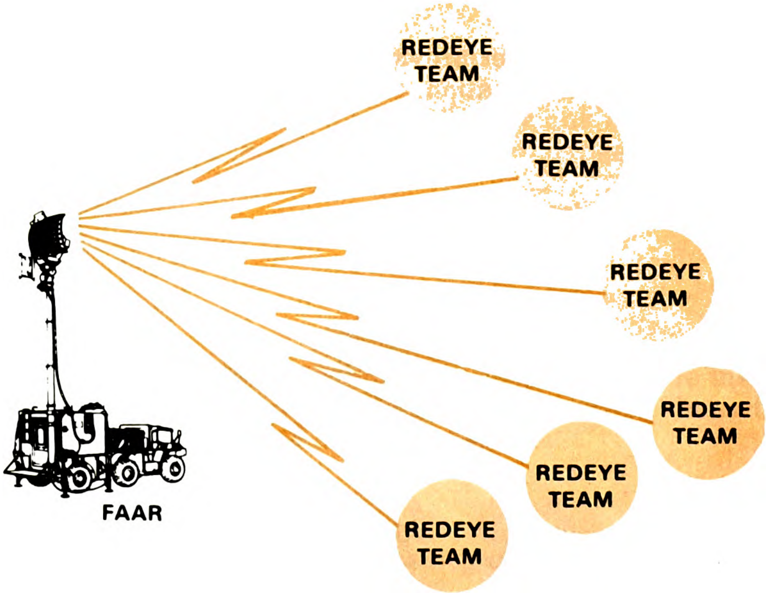

Figure 11-40. FAAR/TADDS Net.

Redeye teams receive alert warning via a one-way voice radiofrequency data link (RFDL) with a FAAR section.

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CHAPTER 12 COMMUNICATIONS EQUIPMENT

12-1 RADIO SETS AND ANCILLARY EQUIPMENT

Frequency modulated (FM) radio sets in the AN/VRC-12 series are the most commonly used radios in air defense artillery units. They are short-range radio sets designed for general use, and may be found in a mobile or fixed configuration. Three standard components combine in various ways to form eight standard configurations. The basic components include a receiver/transmitter (RT), either the RT 246/VRC or RT 524/VRC, and an auxiliary receiver R-442/VRC. In addition, the configurations include an antenna AS-1729/VRC.

- **The AN/VRC-12 Family of Radio Sets.**
  - **Components:**
    - **Receiver-Transmitter RT-246/VRC (fig 12-1).**

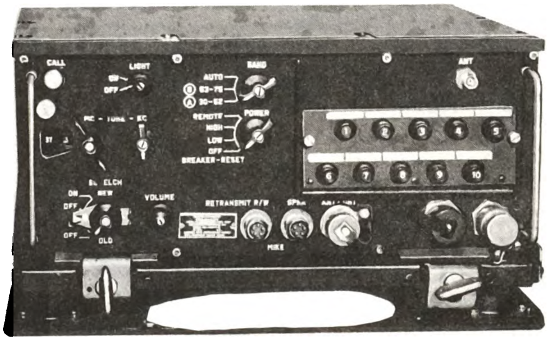


Figure 12-1. Receiver-Transmitter RT-246/VRC.

The Receiver-Transmitter RT-246/VRC is the receiver transmitter used in radio sets AN/VRC-12 and AN/VRC-43 through 45.

- **Receiver-Transmitter RT-524/VRC (fig 12-2).**

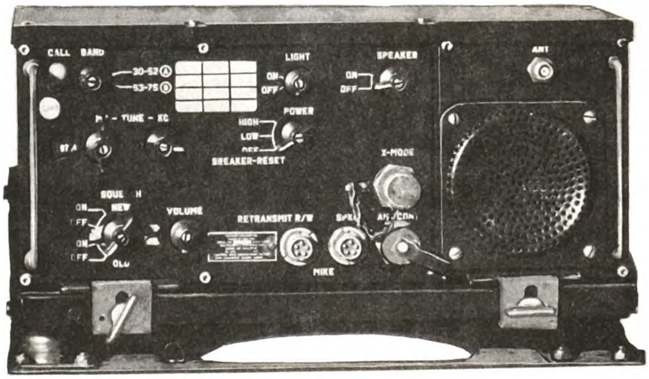


Figure 12-2. Receiver-Transmitter RT-524/VRC.

The RT-524/VRC is the receiver transmitter used in radio sets AN/VRC-46 through 49.

Both models of the receiver-transmitter are essentially the same except the RT-246 has 10 automatic preset frequencies and remote channel power select capability, and the RT-524 is equipped with a built-in loud speaker.

Table 12-1. Technical Characteristics of AN/VRC-12 Series.

TYPE OF SERVICE	SINGLE CHANNEL VOICE
FREQUENCY RANGE	BAND A 30 TO 52.95 MHz BAND B 53 TO 75.95 MHz
PLANNING RANGE	LOW 8 Km HIGH 41 Km
REMOTE OPERATION	USES AN AN/GRA-39 OR AN/GRA-6

Reference: TM 11-5820-401-34-3

☐ Receiver, Radio R-442/VRC (fig 12-3).

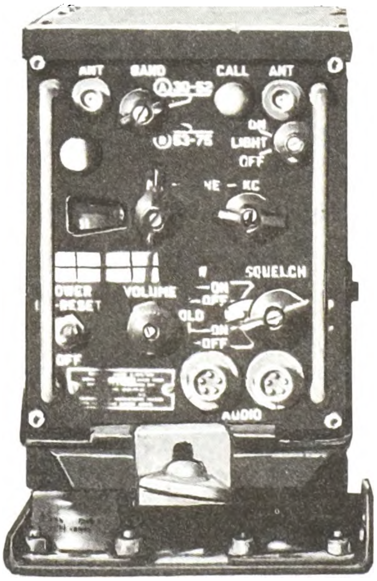


Figure 12-3. Receiver, Radio R-442/VRC.

The R-442/VRC is the auxiliary FM receiver of radio sets AN/VRC-12, AN/VRC-44, AN/VRC-47, and AN/VRC-48.

Table 12-2. Technical Characteristics of R-442/VRC.

TYPE OF SERVICE	SINGLE CHANNEL VOICE
FREQUENCY RANGE	BAND A 30 TO 52.95 MHZ BAND B 53 TO 75.95 MHz
REMOTE OPERATION	USES AN AN/GRA-39 OR AN/GRA-6

Reference. TM 11-5820-401-12

Table 12-3. 12—Series Radio Configurations (ADA use).

CONFIGURATION	COMPONENTS
AN/VRC-44	(1) RT-246/VRC (2) R-442/VRC
AN/VRC-46	(1) RT-524/VRC (operating on one frequency)
AN/VRC-47	(1) RT-524/VRC (operating on one frequency) (1) R-442/VRC (operating on another frequency)
AN/VRC-48	(1) RT-524/VRC (2) R-442/VRC
AN/VRC-49	(2) RT-524/VRC (each operating on a different frequency)
AN/VRC-12	(1) RT-246/VRC (operating on one frequency)

Radio Set AN/PRC-77

The AN/PRC-77 (fig 12-4) is a short-range, lightweight, frequency modulated (FM), fully transistorized radio set that can be either vehicle mounted or man carried, and can be operated with speech security equipment.

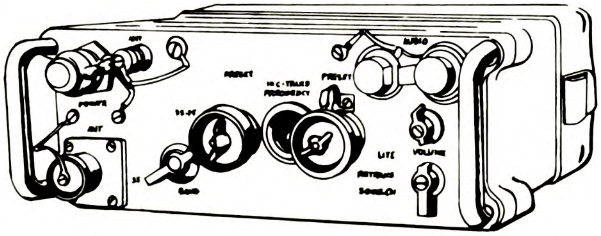


Figure 12-4. Radio Set AN/PRC-77.

Table 12-4. Technical Characteristics of AN/PRC-77.

TYPE OF SERVICE	SINGLE CHANNEL VOICE
FREQUENCY RANGE	LOW BAND 30 TO 52.95 MHz HIGH BAND 53 TO 75.95 MHz
PLANNING RANGE	8 Km

Reference: TM 11-5820-667-12

Radio Set AN/GRC-160

Radio set AN/GRC-160 (fig 12-5) incorporates the components and operational characteristics of the portable FM radio set AN/PRC-77 and the vehicular radio set AN/VRC-64. The AN/PRC-77 can be operated as a portable radio by removing it from the vehicle mount.

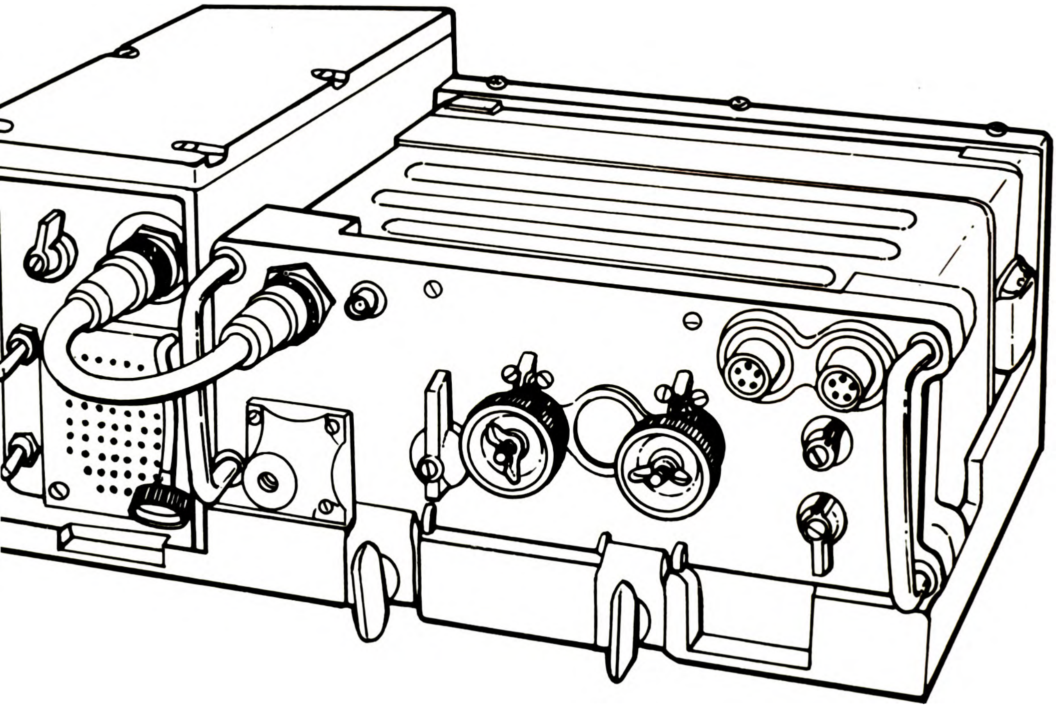


Figure 12-5. Radio Set AN/GRC-160.

Table 12-5. Technical Characteristics of AN/GRC-160.

RADIO CHARACTERISTICS	SAME AS AN/PRC-77

Radio Set Control Group AN/GRA-39

The AN/GRA-39 (fig 12-6) is a transistorized remote control system used to provide remote operation of FM radio sets. The set consists of a local control unit and a remote control unit. Two-way telephone communication between two units and monitoring and control of an FM radio set from either unit are operational features of the system.

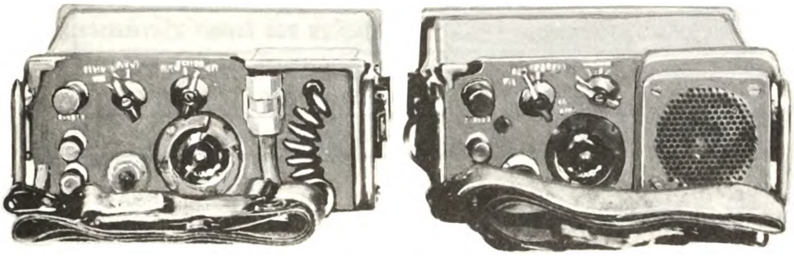


Figure 12-6. Radio Set Control Group AN/GRA-39.

Table 12-6. Technical Characteristics of AN/GRA-39.

TYPE OF SERVICE	VOICE
FREQUENCY RANGE (VOICE)	300-3,500 Hz
PLANNING RANGE	3.2 Km (using field wire WD-1/TT)

Reference: TM 11-5820-477-12

Radio Set AN/GRA-106A

The AN/GRC-106A (fig 12-7) is a high-frequency, amplitude modulated (AM), single-sideband (SSB) radio receiving-transmitting set used primarily as a mobile link in a communications network.

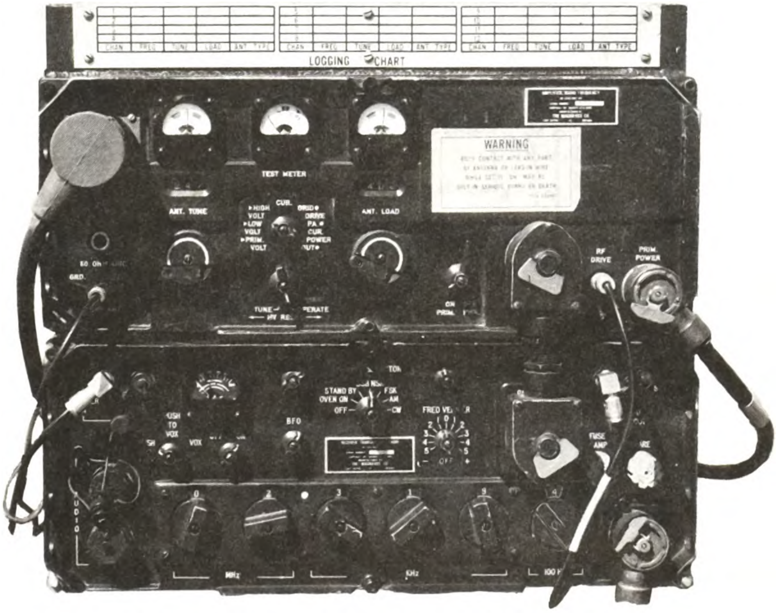


Figure 12-7. Radio Set AN/GRA-106A.

Table 12-7. Technical Characteristics of AN/GRA-106A.

TYPE OF SERVICE	SINGLE CHANNEL VOICE
FREQUENCY RANGE	2.0 TO 29.999 MHz
PLANNING RANGE	GROUNDWAVE UP TO 80 Km SKYWAVE 600 TO 2,400 Km
REMOTE OPERATION	USES AN AN/GRA-6

Reference: TM 11-5820-520-12

Radio Teletypewriter Set AN/GRC-142

The AN/GRC-142 (fig 12-8) is used primarily for radio teletypewriter operations. The modified configuration provides for long-range communication of 4,000 km. Secure radio teletypewriter operation is possible when used in conjunction with security equipment. The set is shelter mounted.

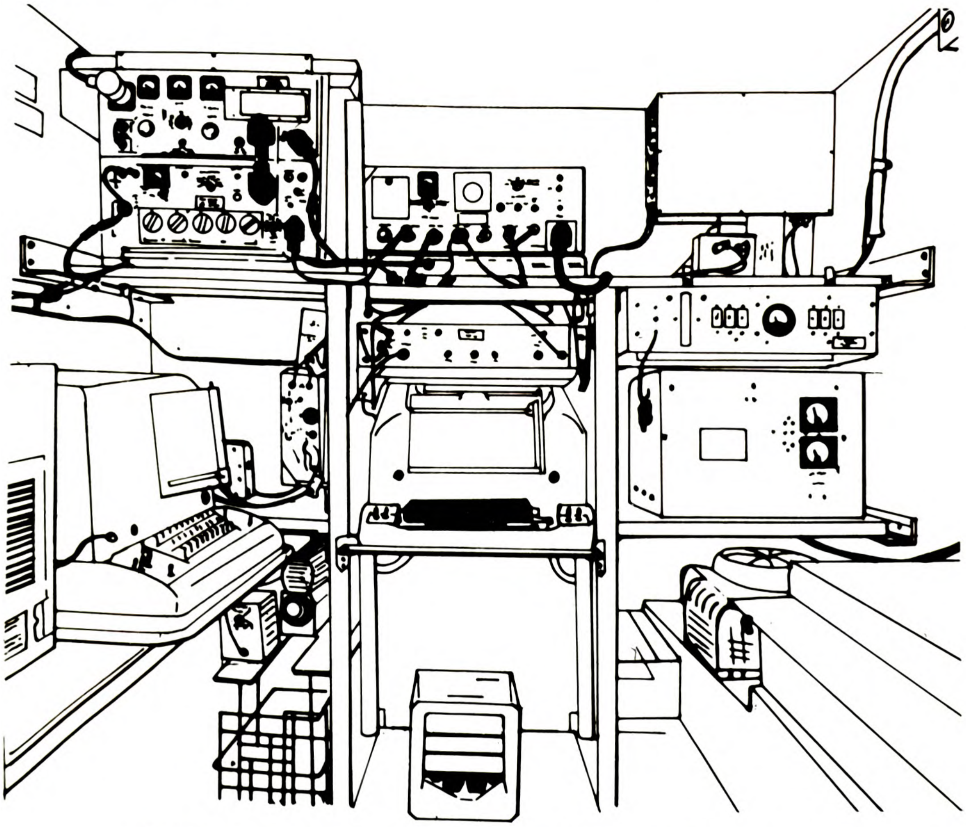


Figure 12-8. Radio Teletypewriter Set AN/GRC-142A.

Radio Teletypewriter Set AN/GRC-122

The AN/GRC-122 (fig 12-9) is a medium-power vehicular radio set primarily used for teletypewriter operations.

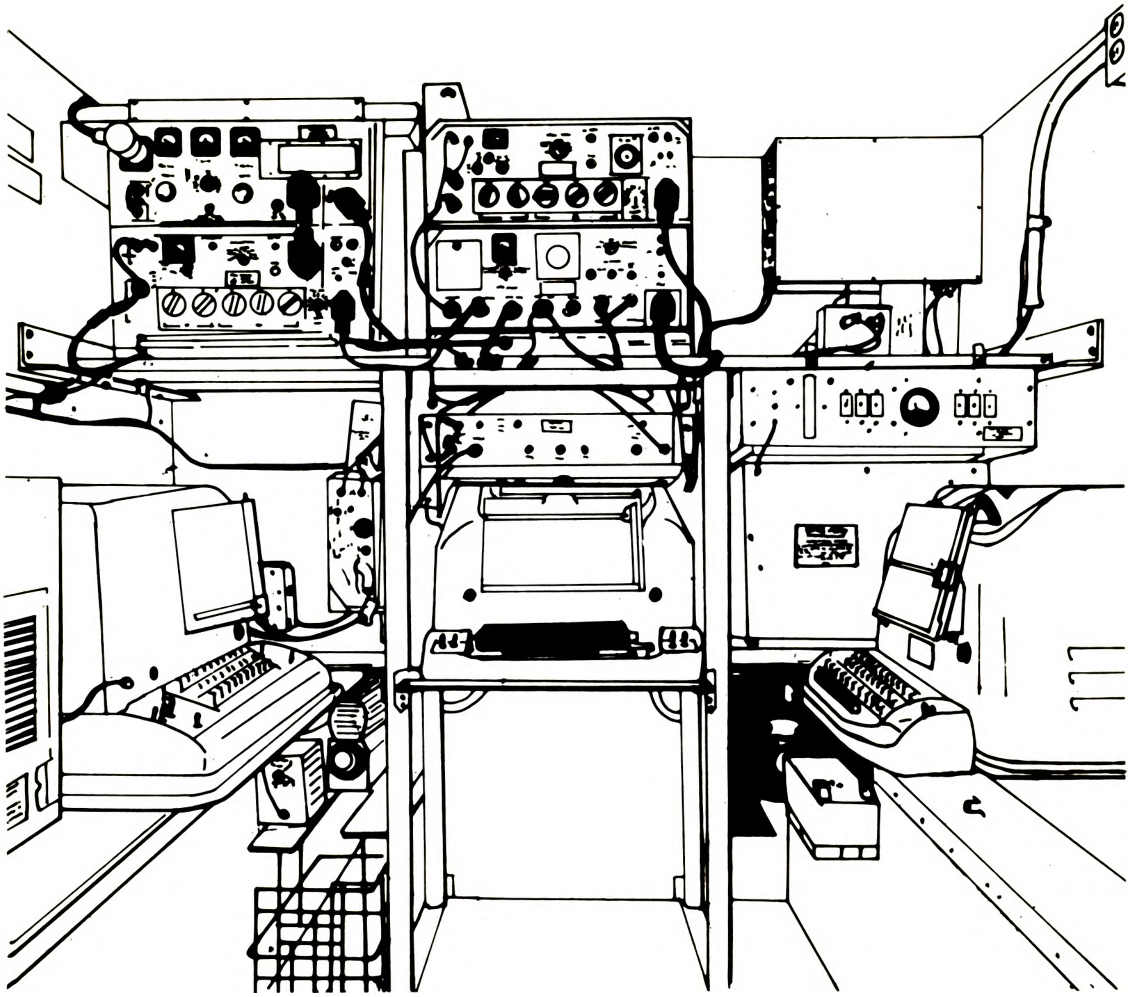


Figure 12-9. Radio Teletypewriter Set AN/GRC-122A.

Table 12-8. Technical Characteristics of AN/GRC-142 and AN/GRC-122.

RADIO CHARACTERISTICS	SAME AS THE AN/GRA-106A

Reference: TM 11-5815-334-12

Radio Teletypewriter Set AN/VSC-2

The AN/VSC-2 (fig 12-10) is vehicular-mounted and installed in a ¼-ton vehicle. The radio components of this set are the same as the AN/GRC-106A with additional equipment provided for radio teletypewriter communications. The equipment is peculiar to airborne ADA units. Communications security equipment may be used with this set.

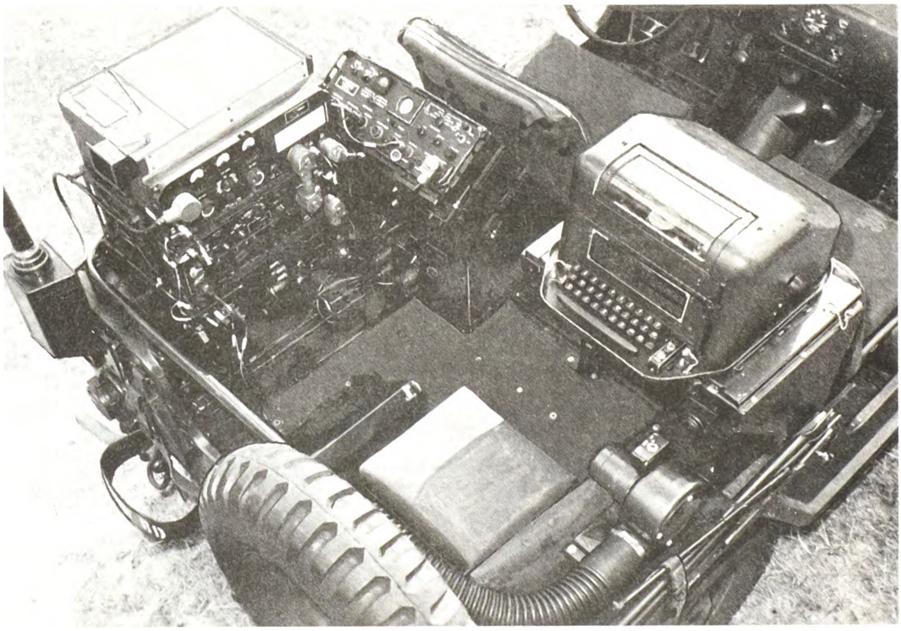


Figure 12-10. Radio Teletypewriter Set AN/VSC-2.

Table 12-9. Technical Characteristics of AN/VSC-2.

RADIO CHARACTERISTICS	SAME AS THE AN/GRC-106A

Reference: TM 11-5815-331-14

Radio Set AN/GRC-103

The AN/GRC-103 (fig 12-11) is a compact, transportable radio set which provides facilities for multichannel transmission and reception of pulse code modulation signals. It will accommodate up to 24 telephone channels when used with appropriate multiplex equipment. The set is normally employed in radio terminal or repeater stations.

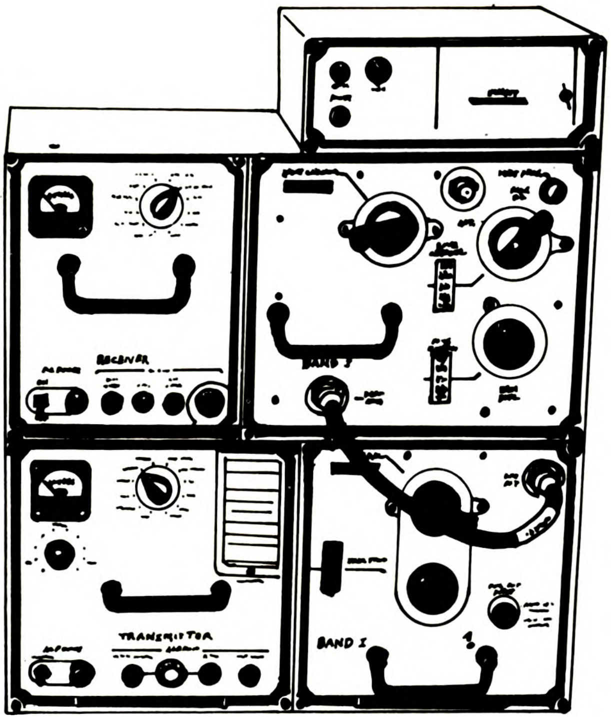


Figure 12-11. Radio Set AN/GRC-103.

Table 12-10. Technical Characteristics of AN/GRC-103.

TYPE OF SERVICE	VOICE
FREQUENCY RANGE	BAND I 220 - 404.5 MHz BAND II 394.5 - 705 MHz BAND III 695 - 1,000 MHz BAND IV 1,200 - 1,800 MHz
PLANNING RANGE	80 Km LINE OF SIGHT

Reference: TM 11-5820-540-12

Radio Terminal Set AN/TRC-145

Radio terminal set AN/TRC-145 (fig 12-2) is a 12-channel radio terminal that provides for data link and voice communication in the ADA command and control multichannel network.

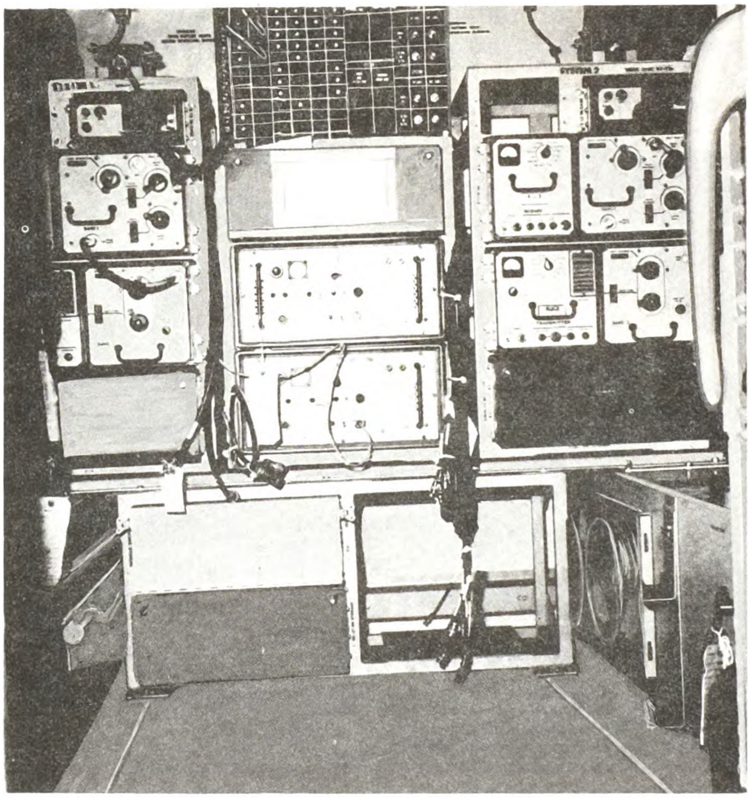


Figure 12-12. Radio Terminal Set AN/TRC-145.

Table 12-11. Technical Characteristics of AN/TRC-145.

RADIO CHARACTERISTICS	SAME AS THE AN/GRC-103
MULTIPLEX CHARACTERISTICS	12-CHANNEL VOICE

Reference: TM 11-5895-453-14

Radio Repeater Set AN/TRC-113

The AN/TRC-113 (fig 12-13) is a 12-channel radio repeater station used to extend the range between two radio terminal stations (AN/TRC-145).

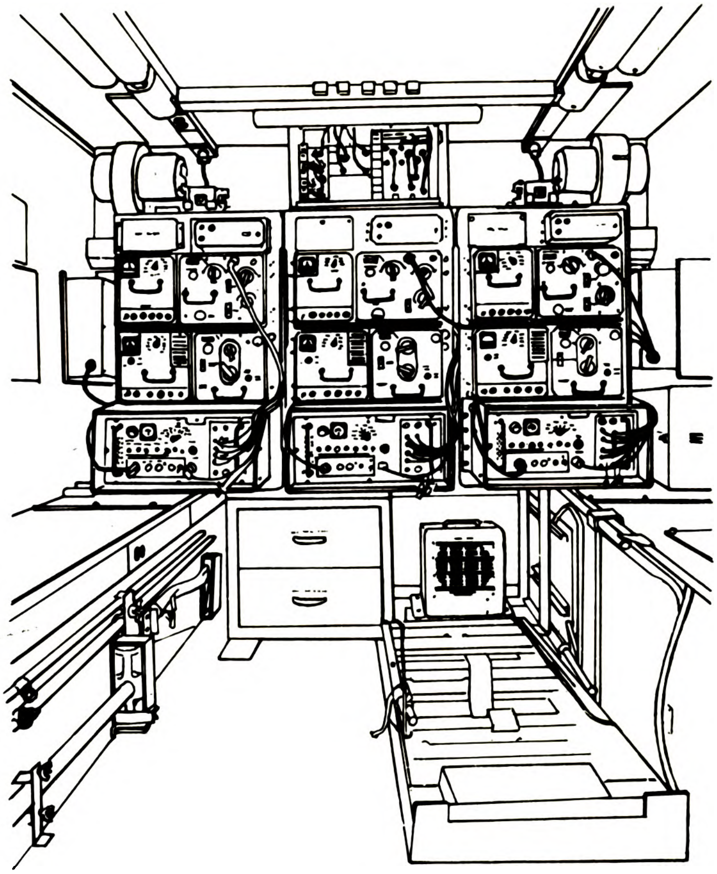


Figure 12-13. Radio Repeater Set AN/TRC-113.

Table 12-12. Technical Characteristics of AN/TRC-113.

RADIO CHARACTERISTICS	SAME AS THE AN/GRC-103
MULTIPLE CHARACTERISTICS	12-CHANNEL VOICE

Reference: TM 11-5820-562-14

12-2 WIRE COMMUNICATIONS EQUIPMENT

Telephone Set TA-1/PT

Telephone set TA-1/PT (fig 12-14) is sound powered and provides facilities for talking and signaling without batteries. This set can be used in forward areas, in switched networks having magneto signaling switchboards, in closed nets, and in point-to-point circuits.

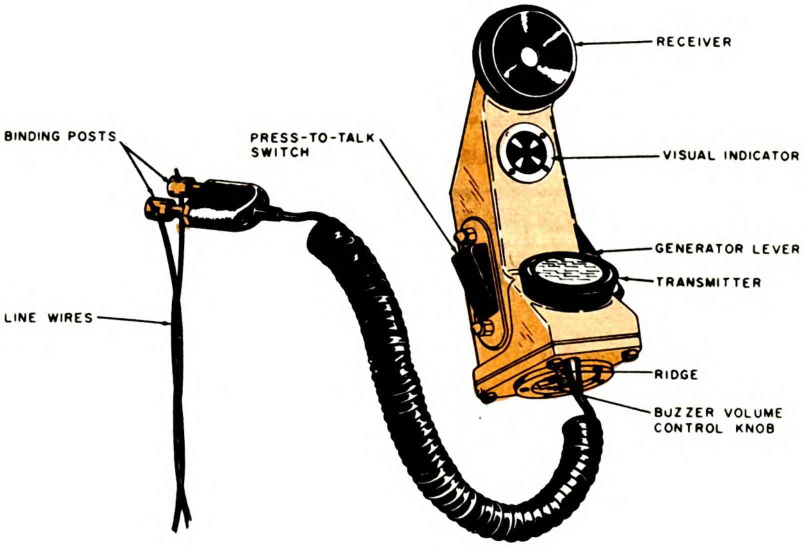


Figure 12-14. Telephone Set TA-1/PT.

Table 12-13. Technical Characteristics of TA-1/PT.

TALKING AND SIGNALING RANGE	9.26 TO 16 Km USING WD-1/TT WIRE
SIGNALING INDICATIONS	VISUAL OR AUDIO-VISUAL

Reference: TM 11-5805-243-12

Telephone Set TA-312/PT

Telephone set TA-312/PT (fig 12-15) is a small, rugged, waterproof portable field telephone designed primarily for operation in the field on a local battery system. It will also operate on a common battery system and common battery signaling system.

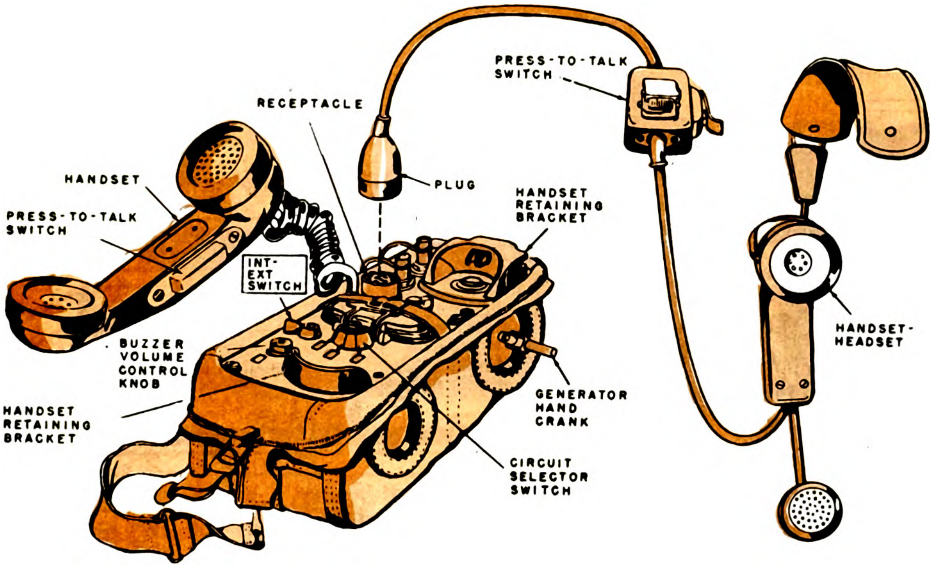


Figure 12-15. Telephone Set TA-312/PT.

Table 12-14. Technical Characteristics of TA-312/PT.

TALKING AND SIGNALING RANGE	USING WD-1/TT WIRE, FROM 22.4 Km (WET LINES) TO 38.4 Km (DRY LINES) (TYPE CONDUCTOR USED AFFECTS RANGE)
HANDSET-HEADSET USE CAPABILITY	
SIGNALING INDICATIONS	AUDIBLE (ADJUSTABLE)

Reference: TM 11-5805-201-12

Manual Telephone Switchboards

Field telephone switchboards are manually operated, constructed to withstand rough handling, and designed for quick, simple installation.

Switchboard SB-993/GT.

Switchboard SB-993/GT (fig 12-16) is a light, portable, local battery switching center normally used in company size units.

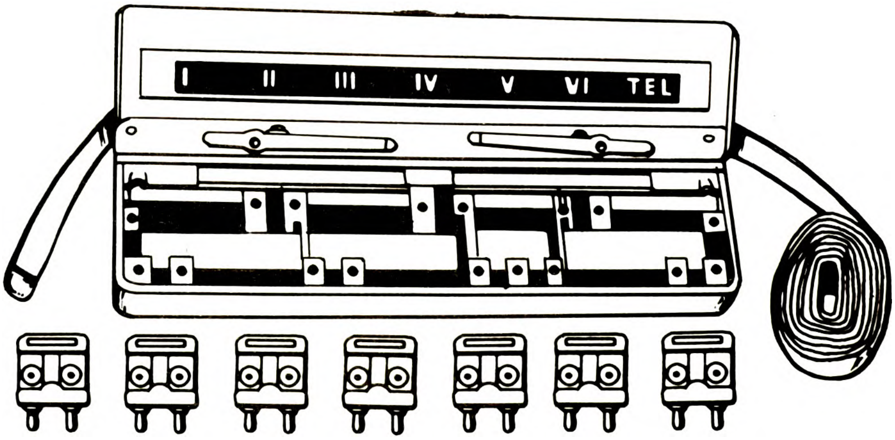


Figure 12-16. Telephone Switchboard SB-993/GT.

Table 12-15. Technical Characteristics of SB-993/GT.

LINE CAPACITY	OPERATES LINE AND 6 LOCAL BATTERY CIRCUITS

Reference: TM 11-5805-294-15

■ Switchboard SB-22/PT.

Switchboard SB-22/PT (fig 12-17) is a single-position field switchboard used primarily in field wire systems. It is small, lightweight, portable, immersion-proof and requires no special mounting.

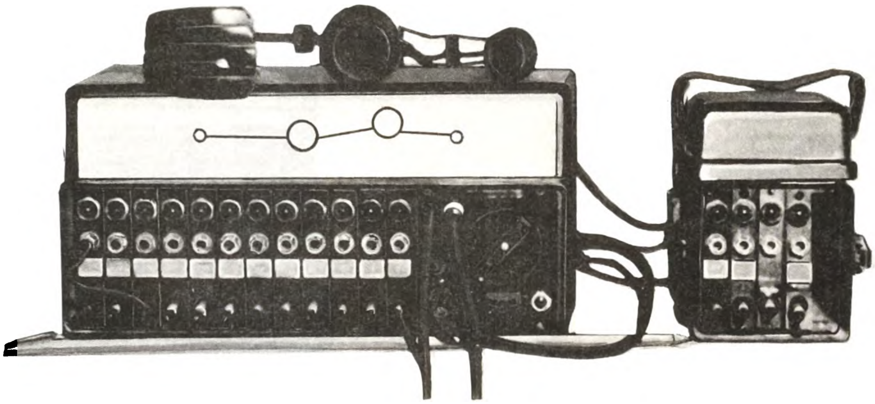


Figure 12-17. Manual Telephone Switchboard SB-22/PT.

Table 12-16. Technical Characteristics of SB-22/PT.

LINE CAPACITY	SWITCHING EITHER 12 FIELD TELEPHONES, 12-VOICE—FREQUENCY TELETYPEWRITER CIRCUITS, 12-REMOTE-CONTROL CIRCUITS (FOR RADIO COMMUNICATIONS), OR A COMBINATION OF THESE. A CAPACITY OF 29 CIRCUITS CAN BE OBTAINED BY STACKING 2 SWITCHBOARDS.

Reference: TM 11-5805-262-12.

■ Switchboard SB-86/P.

Terminal telephone switchboard SB-86/P (fig 12-18) is a portable, 30-line, retractable cord, field switchboard. It will operate in either a common-battery or local battery signaling system and provides conference facilities. The SB-86/P can provide radio/wire integration facilities when used in conjunction with SB-22/PT switchboard.

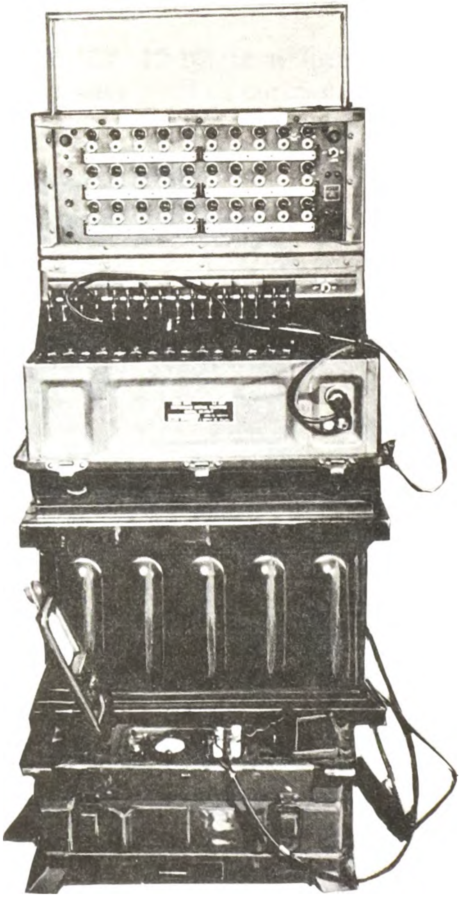


Figure 12-18. Manual Telephone Switchboard (SB-86/P).

Table 12-17. Technical Characteristics of SB-86P.

LINE CAPACITY	30 CIRCUITS (USING ONE JACK) 60 CIRCUITS (USING TWO JACKS)
SIGNALING	AUDIBLE-AUTOMATIC AND MANUAL
OPERATING DISTANCE: (USING WD-1/TT WIRE) MAGNETO SIGNALING COMMON BATTERY SIGNALING	 35 Km VARIABLE - 7.2 TO 14 Km

Reference: TM 11-4134

Field Wire and Field Cable

Table 12-18. Field Wire WD-1/TT.

Length	¼ mile (.4 Km) ½ mile (.8 Km) 1 mile (1.6 Km)
Weight	48 lb per mile (1.6 Km)
Resistance	234 ohms per mile
Tensile strength (in lbs)	200

Table 12-19. Cable, Telephone (Four Wire, Field Wire) WF-16U.

Length	1 mile (1.6 Km)
Weight	390 lb per mile (1.6 Km)
Tensile strength (in lbs)	200

Table 12-20. Twenty-six Pair Cable, WM-130/G.

Length	250, 25, or 15 ft
Weight	150 lb per 1,000 ft
Tensile strength (in lbs)	700

References: TM 11-381, TM 11-5995-205-15

12-3 COMMUNICATIONS SECURITY EQUIPMENT

Speech Security Equipment

The TSEC/KY-8 and the TSEC/KY-38 are tactical, push-to-talk speech security devices designed to provide secure FM voice communications. Used within all ADA organizations, these devices greatly enhance the security and responsiveness of ADA units in tactical operations. This equipment is unclassified for external viewing, but is classified a minimum of CONFIDENTIAL for internal viewing.

- The TSEC/KY-8 was designed to be mounted in a vehicle (wheel, track, vessel, or aircraft) and is used with the AN/VRC-12 series radios.

Reference: TB 11-5810-224-14-2

- The TSEC/KY-38 is a speech security device used with the AN/VRC-12 and AN/PRC-77 series radios.

Reference: TB 11-5810-245-14-2

USER NOTE: The HYL-3/TSEC digital regenerative repeater is required at a retransmission station to enable it to pass secure speech transmissions. It can be used with either the AN/VRC-12, or AN/PRC-77 series radios.

Reference: TB 11-5810-247-14-2

Teletype Security Equipment TSEC/KW-7

The TSEC/KW-7 is on-line, portable, synchronous, half-duplex, teletypewriter security equipment. It is used for securing tactical point-to-point or netted communications.

Reference: TM 11-5810-221-12P

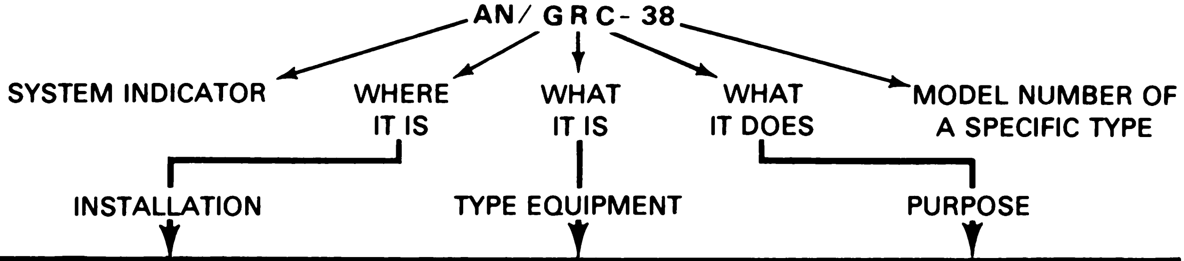
Multichannel Security Equipment

The TSEC/KG-27 is used to provide secure ADA multichannel communications circuits.

12-4 JOINT COMMUNICATIONS—ELECTRONICS EQUIPMENT DESIGNATION SYSTEM

All signal equipment nomenclature starting with "AN-" indicates the Joint Communications-Electronics Equipment Designation System was used to identify the signal end item. The table below identifies the meaning of the letters and numbers used in this designation system.

Table 12-21. ***Joint Communications-Electronics Equipment Designation System.***



A	airborne installed and operated in aircraft)
B	underwater mobile, submarine
C	air transportable (inactivated, do not use)
D	pilotless carrier
F	fixed
G	ground, general ground use (including two or more ground installations)
K	amphibious
M	mobile (installed as operating unit in a vehicle which has no function other than transporting the equipment
P	pack or portable (animal or man)
S	water surface craft
T	ground transportable
U	general utility (includes two or more general installation classes, airborne, shipboard, and ground)
V	ground, vehicular (installed in vehicle designed for functions other than carrying electronic equipment, etc., such as tanks)
W	underwater, fixed

A	invisible light, heat radiation
B	pigeon
C	carrier (wire)
D	radiac
F	photographic
G	telegraphic or teletype (wire)
I	interphone and public address
K	telemetering
L	countermeasures (inactivated, do not use)
M	meteorological
N	sound in air
P	radar
Q	sonar and underwater sound
R	radio
S	special types, magnetic, etc., or combinations of types
T	telephone (wire)
V	visual and visible light
X	facsimile or television

A	auxiliary assemblies (not complete operating sets)
B	bombing
C	communications (receiving and transmitting)
D	direction finder
G	gun or searchlight directing
H	recording (photographic, meteorlogical, and sound)
J	countermeasurer, receiving and transmitting
L	searchlight control (inactivated use "G")
M	maintenance and test assemblies (including tools)
N	navigational aids (including altimeters, beacons, compasses, racons, depth sounding, approach and landing)
P	reproducing (photograph and sound)
Q	special or combination of types
R	receiving
S	detecting and/or range and bearing
T	transmitting
W	remote control
X	identification and recognition

◆◆◆

CHAPTER 13 TACTICAL EMPLOYMENT

13-1 GENERAL

Air defense includes Air Force interceptor aircraft and Army air defense weapons systems. No single air defense weapon can counter a variety of aircraft ordnance, attack techniques, and countermeasures. To protect against air attack, the force commander first establishes air defense priorities, based on his estimate of the tactical significance and relative vulnerability of potential targets. Air defense weapons are then deployed—according to target priority—using mixes of weapons—by massing them in areas to be defended. This chapter provides a brief overview of the tactical employment of ADA weapons. For more detailed information, the reader should consult the How-to-Fight series of ADA field manuals:

FM 44-1	US Army Air Defense Artillery Employment
FM 44-3	Air Defense Artillery Employment, Chaparral/Vulcan
FM 44-23	US Army Air Defense Artillery Employment, Redeye
FM 44-90	Air Defense Artillery Employment, Hawk

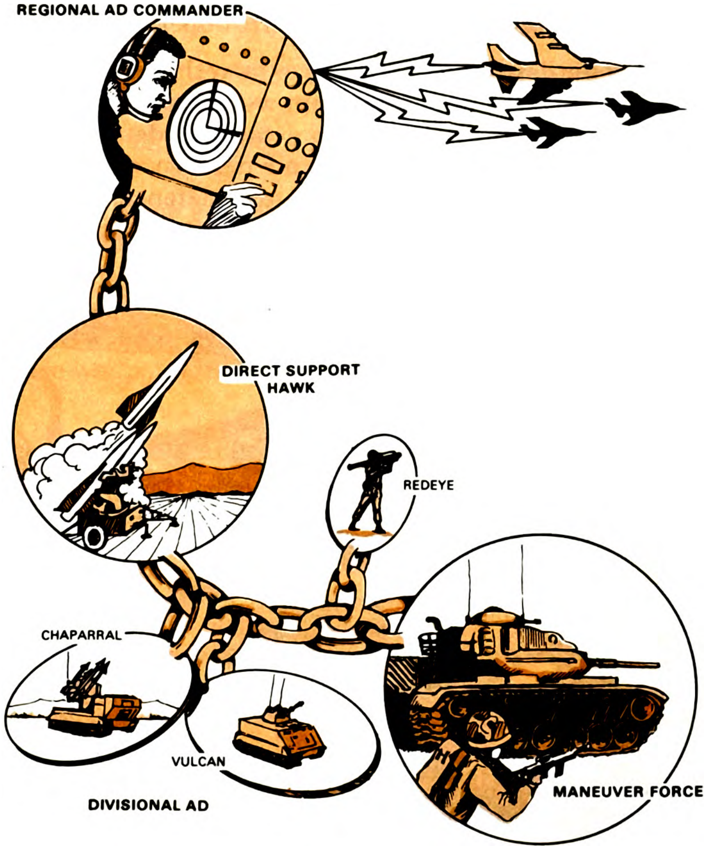


Figure 13-1. Air Defense Control and Coordination.

13-2 ALLOCATION OF RESOURCES

When properly employed, ADA weapons enable the corps and its divisions to maneuver on the battlefield without suffering undue losses of combat power from hostile air attack. ADA assets are limited, however, and commanders must carefully select what they want protected. ADA weapons best support tactical operations by protecting the commander's most critical assets. To insure the survivability of his force and the preservation of its combat power, the commander must augment his active air defenses with passive measures such as dispersion and camouflage. He must also avoid establishing lucrative target complexes by reducing to a minimum the physical size of critical assets such as DTOCs, CPs, ASPs, POL points, and troop concentrations.

13-3 WEAPON MIX AND MASS

A complementary mix of air defense weapons provides all-altitude coverage, and prevents the enemy from exploiting any one particular attack option. A mix of weapons allows the capabilities of one system to offset the limitations of another system and prevents the air threat from defeating any particular weapon system. An integrated air defense can protect against low-performance aircraft and helicopters flying at ground level, as well as against high-performance aircraft operating at all altitudes.

Massing air defense weapons on or near the critical asset to be defended provides massed fires and maximum weapons effects. This also makes it more difficult for enemy aircraft to attack air defense sites or to suppress fires. Massing does not imply that air defense weapons remain in static positions. They move to provide air defense for a highly mobile maneuvering force. They should also be moved frequently to minimize the chances of detection and suppression.

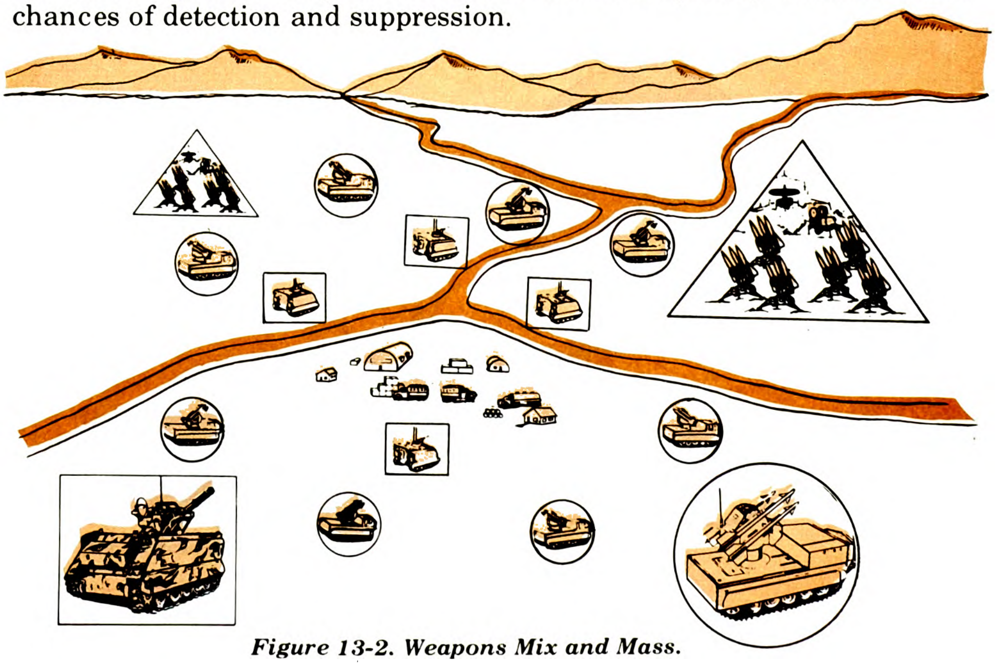


Figure 13-2. Weapons Mix and Mass.

13-4 FIRE CONTROL AND COORDINATION

Command and control of air defense fires is accomplished by commanders at all levels within a framework established by the theater commander. He centralizes responsibility for air defense in a single individual (normally the Air Force component commander) who becomes the Area Air Defense Commander. The Area Air Defense Commander establishes rules of engagement and other procedures to insure timely engagement of hostile aircraft without endangering friendly aircraft. The procedures include conditions of readiness, states of alert, air defense warnings, weapon control and hostile criteria. These rules and procedures prescribed for the theater provide the framework for coordinating the fires of all air defense weapons at all echelons.

Control of air defense fires differs for each weapon system. Electronic command and control systems help control the fires of the long-range and medium-range missile systems found at theater army and corps levels. The necessity for responsiveness of the short-range systems requires that the authority to engage aircraft be delegated to the weapons commander. However, all air defense weapons are integrated through the common procedures mentioned earlier, and through command and control ties, to provide a cohesive, responsive air defense for the force as a whole.

13-5 SHORT-RANGE WEAPONS

The family of short-range air defense weapons currently includes Redeye, Vulcan, and Chaparral. Redeye, a portable, shoulder-fired missile, furnishes immediately responsive air defense protection for the front-line combat battalion. When subjected to air attack, battalion and company commanders augment Redeye by aggressive use of small arms and automatic weapons in an air defense role.

Chaparral/Vulcan (C/V) battalions are organic to the division, and additional battalions are found at corps and theater levels. These systems provide a flexible response to the air threat and are employed to defend the priorities of the division, corps, and theater commanders within a division.

■ In defensive situations, the C/V battalion commander task organizes his batteries to provide a mix of missiles and guns in defense of critical assets. Vulcans are placed right on or near the defended asset to provide massed fires, and Chaparrals are placed out from the defended asset for early engagement. Front-line elements rely on Redeye, small arms, and passive measures for their protection against low-altitude air attacks.

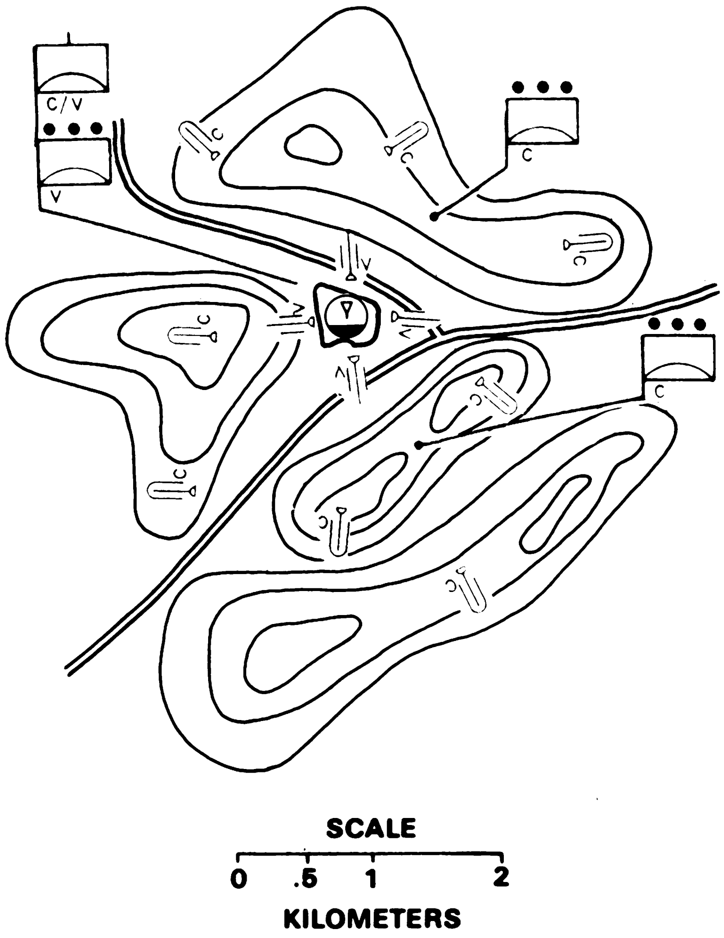


Figure 13-3. Short-Range Weapons in a Defensive Situation.

■ In offensive situations, the C/V battalion commander task organizes his batteries to support the scheme of maneuver. During offensive operations, front-line elements must expose themselves to aerial observation and thereby increase their vulnerability to air attack. Vulcan's mobility, its ability to defend itself against both air and ground attack, and its high volume of fire make it particularly suitable for the mission of providing air defense protection for forward maneuver elements. In the face of a significant air threat to those elements, a Vulcan platoon is committed to the defense of a company-sized maneuver force. Such missions are highly selective, however, because of the limited number of Vulcans available. Vulcans deployed with front-line companies can deliver effective suppressive fires against ground targets whenever the tactical situation warrants and ammunition supplies permit. Vulcan's firepower in the ground role can also be effectively used by the maneuver force commander to enhance his local security—especially during hours of darkness.

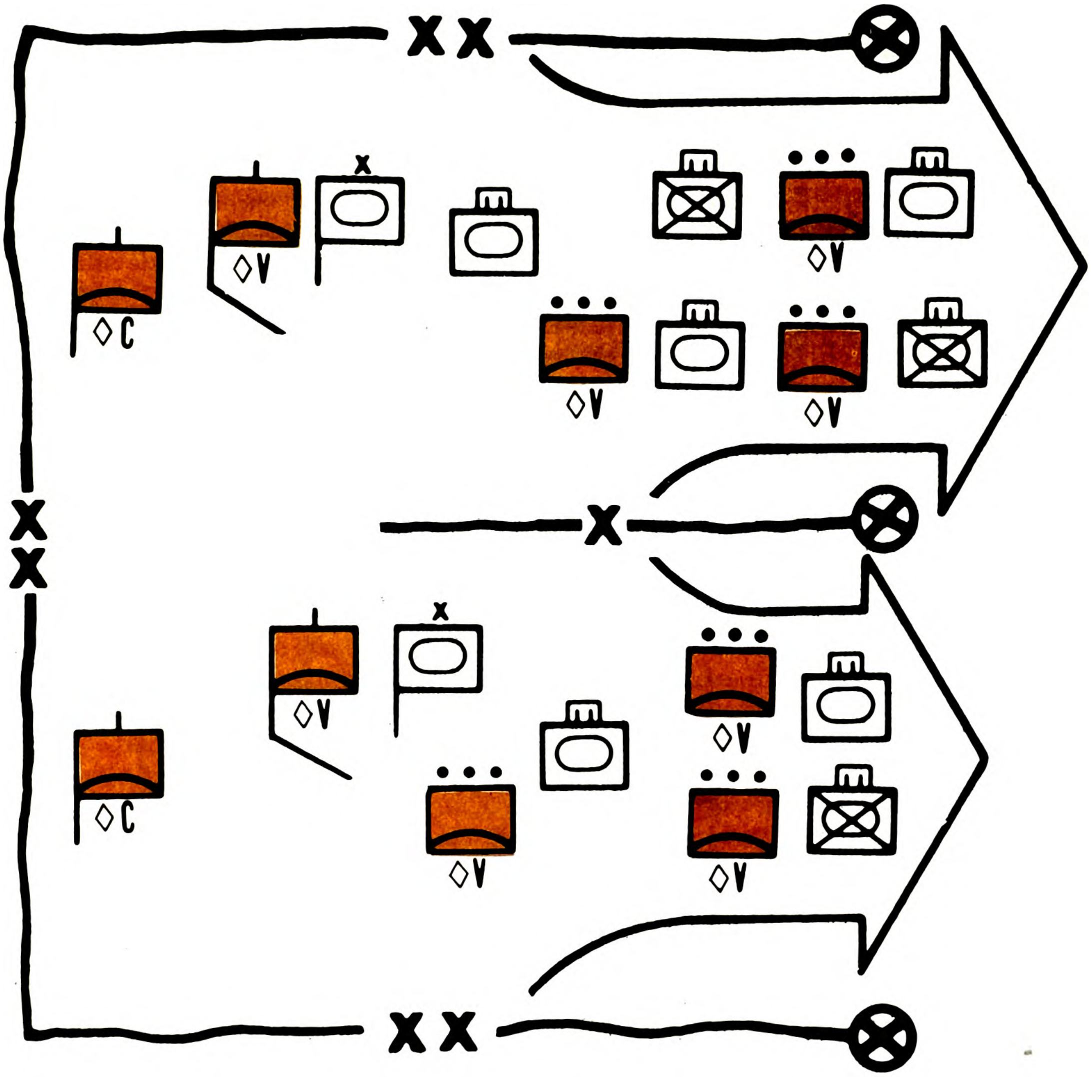


Figure 13-4. Short-Range Weapons in an Offensive Situation.

Commanders must establish realistic priorities for Chaparral and Vulcan. These are priorities of the moment and will constantly change as the battle progresses. In a defensive situation, assets in the rear are generally the most vulnerable. In the offense, priorities are shifted toward the forward maneuver elements. During any main effort by a division, the Chaparral/Vulcan battalion frequently will be overstressed and will need to call on corps ADA for reinforcement.

13-6 MEDIUM-RANGE WEAPONS

Hawk battalions are deployed in forward areas for protection of ground forces and control and supporting forces. Hawk battalions are deployed in rear areas for protection of critical assets such as logistics complexes and air bases.

The Hawk battalion in direct support of each division serves a dual purpose. First, it provides low- and medium-altitude coverage over the battlefield. Second, it provides the interface necessary to integrate the division's air defenses into the overall air defense scheme of the theater. Hawk batteries are positioned in the division zone to provide an in-depth defense. When the division moves, Hawk units displace by battery or platoon to maintain continuous coverage of forward maneuver elements and to help protect critical assets in the division rear.

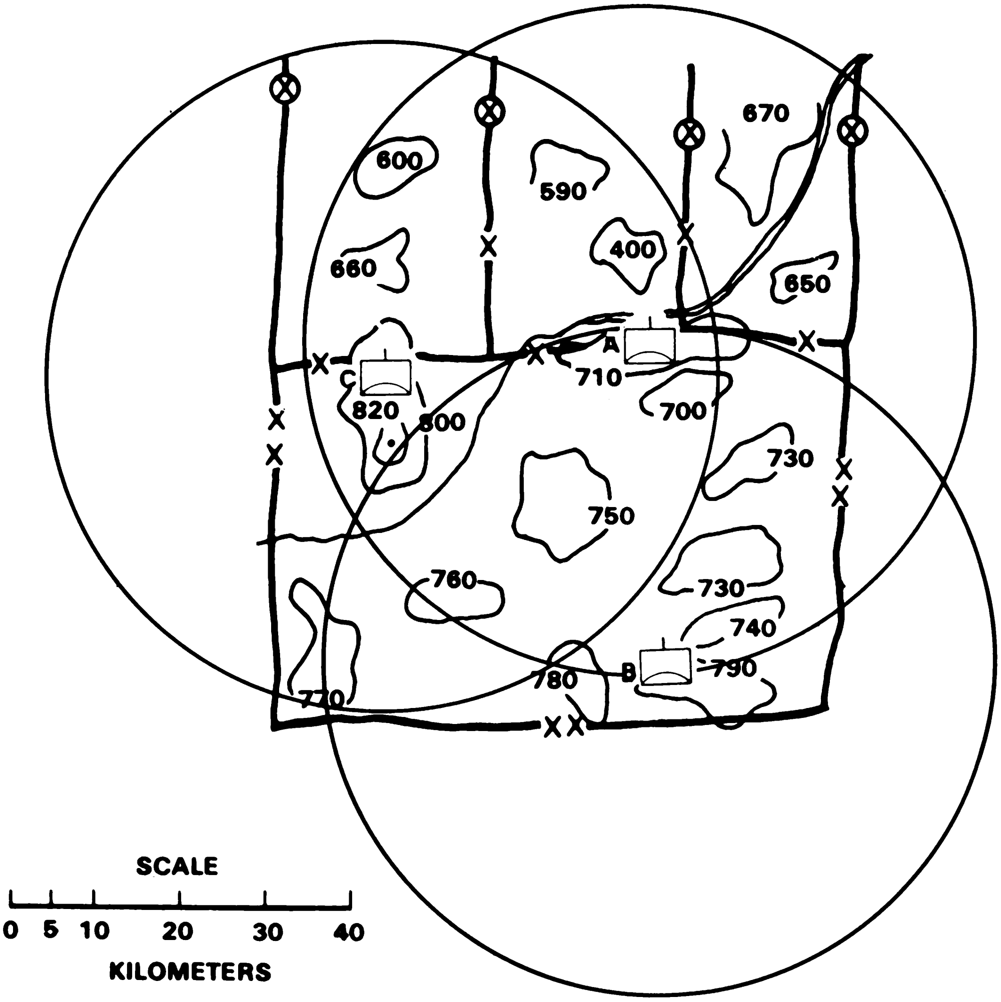


Figure 13-5. Hawk Deployment in a Division Area.

13-7 LONG-RANGE WEAPONS

To complete the scheme for air defense of the field force, Nike Hercules battalions are positioned in the rear area. Together with Air Force interceptor aircraft, Nike Hercules provides medium-to-high altitude coverage over a large part of the battlefield as well as the critical assets to the rear of the corps. The Nike Hercules, when not needed in the air defense role, can also deliver accurate surface-to-surface fires (e.g., to help suppress enemy air defenses).

13-8 UNIT SELF-DEFENSE

As noted earlier, units weapons are never denied the right of self-defense. When a unit is subjected to air attack from low altitudes, all elements make full use of Redeye, automatic weapons, and small arms in accordance with the rules of engagement. They direct high-volume fires upward at attacking aircraft.

USER NOTE: TC 23-44, Small Arms Defense Against Air Attack, contains detailed procedures for the use of small arms against aircraft.

13-9 COUNTER SUPPRESSION

Air defense units must move frequently to avoid suppressive fires. To avoid hostile reaction, displacement should be considered after suspected enemy air reconnaissance, after firing engagements,or when threatened by enemy ground action or artillery fire. Depending on the enemy's demonstrated capability to act on intelligence, it may be necessary to move more often. Air defense artillery units should turn off their radars whenever possible. Alternate and supplementary firing positions should be chosen and prepared at all sites, with attention to minimizing the unit's vulnerability to suppressive fires.

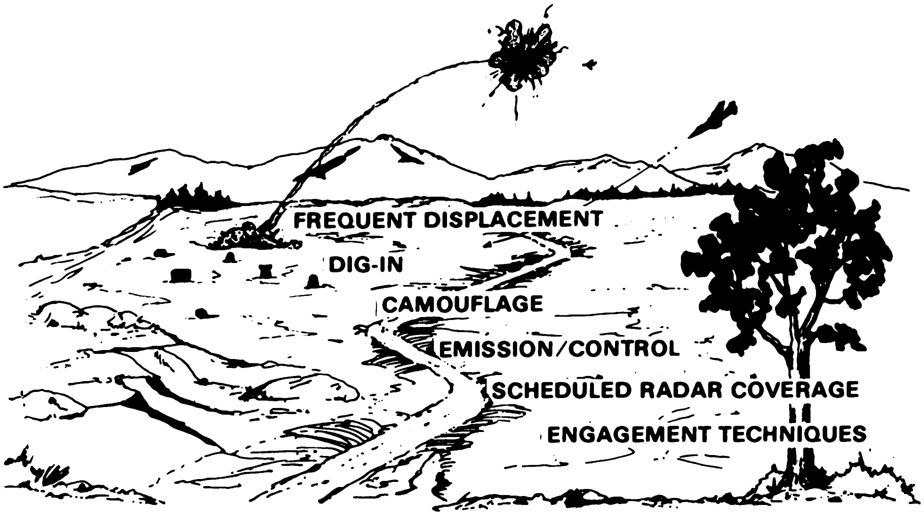


Figure 13-6. Countersuppression Tactics and Techniques.

SUMMARY

Proper employment of the entire family of ADA weapons is essential to the success of the combined arms team. New weapon systems may be fielded in the future, but the basic employment principles—mix, mass, mobility, and integration—will remain the same. The US Army can no longer rely on operating on the battlefield without fear of air attack. Further, friendly fighter interceptors probably will be outnumbered by the enemy's air force—particularly at the very outset of war. The Air Force will consequently be hard pressed to devote much of its effort to defending Army forces from hostile air attack. To win the first battle—outnumbered in the air as well as on the ground—the ground force commander will have to place increased reliance on ADA to provide him the freedom he needs to maneuver on the battlefield.

◆◆◆

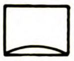
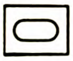
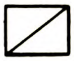
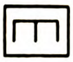
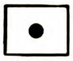
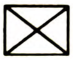
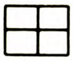
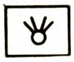
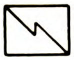
CHAPTER 14 TACTICAL TOOLS

14-1 MILITARY SYMBOLS

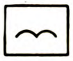
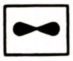
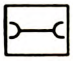
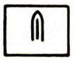
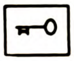
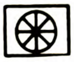
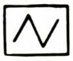
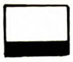
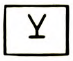
Military symbols contain just enough information to clearly identify a unit, activity, or installation. The military symbols shown here are of interest to ADA personnel. Only US symbols are included. For information about Allied (NATO, SEATO, etc) symbols, see STANAG 2019.

Branch and Duty Symbols

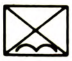
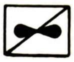
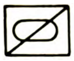
BRANCH

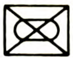
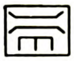
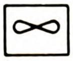
Symbol	Description
	Air Defense Artillery
	Armor
	Cavalry or Reconnaissance
	Engineer
	Field Artillery
	Infantry
	Medical
	Ordnance
	Signal

DUTY (FUNCTIONAL)

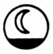
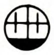
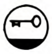
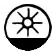
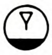
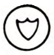
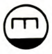
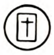
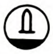
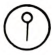
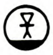
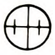
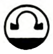
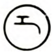
Symbol	Description
	Airborne
	Army Aviation
	Repair and Maintenance
	Rocket and Guided Missile
	Quartermaster
	Transportation
	Electronic warfare
	Supply units
	Air Assault. When the V is combined with a stem, it indicates organic aircraft are available for air movement.

Combining Branch and Duty

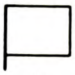
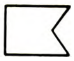
Symbol	Description
	Airborne Infantry (gulls wings and Infantry symbols combined)
	Air Cavalry (Cavalry and Army Aviation symbols combined)
	Armored Cavalry (Cavalry and Armor symbols combined)

Symbol	Description
	Mechanized Infantry (Armor and Infantry symbols combined)
	Engineer, Bridge (Engineer symbol combined with the topographic bridge symbol)
	US Air Force unit, aircraft, facilities, etc. (unshaded propeller)

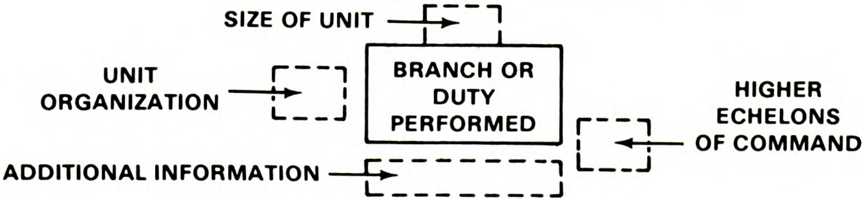
Combat Service Support Symbols

Symbol		Designation	Symbol		Designation
	Class I	Subsistence		Class VIII	Medical Materiel and Repair Parts
	Class II	Clothing, Equipment, Tentage, Supplies		Class IX	Repair Parts
	Class III	POL (Ground)		Class X	Materiel to Support Non-Military Programs
	Class IV	Construction			Graves Services
	Class V	Ammunition (all types)			Traffic Control
	Class VI	Personal Demand Items			Hospital or Aid Station
	Class VII	Major End Items			Water

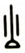
Size and Type of Activity Symbol

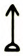
•	Squad/Team	XXX	Corps
• •	Section	XXXX	Army
• • •	Platoon-Detachment	XXXXX	Army Group
	Company-Troop-Battery	□	Unit
II	Battalion-Squadron		Unit Hq
III	Regiment-Group	△	Observation or Listening Post
X	Brigade	○	Logistical Unit
XX	Division/Army AD Command		Combat Service Support

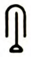
Unit Designation and Basic Symbol

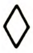


Weapon Symbols


Air Defense Gun

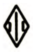

Air Defense Machinegun

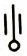

Air Defense Missile

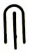

Armored Personnel Carrier

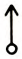
Basic Artillery Gun

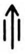
Basic Infantry Weapon

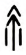

Full-tracked Armored Assault Gun


Howitzer


Missile/Rocket

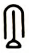

Mortar

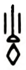

Recoilless Rifle

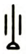

Rocket Launcher

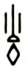
Examples of Air Defense Symbols

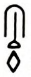
Weapon Symbols

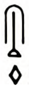

Redeye
R

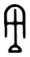

Vulcan SP
6 20
No. of Systems (caliber/mm)

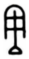

Vulcan (towed)
6 20


M42 (Duster)
4 40-mm

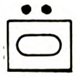

Chaparral (full tracked air defense missile system)
C


Roland (full tracked air defense missile system)
Roland

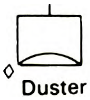

Hawk (medium air defense missile system)


Nike Hercules (heavy air defense missile system)

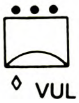
Unit Symbols


Redeye 8-33 XX 21st

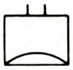
ADA Section, Cbt Spt Co, 8th Bn, 33d Armor, 21st Armored Division

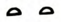

A 3-33
Duster

Btry A, M42 Duster Sp, 3d Bn, 33d ADA

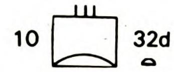

1 A/2-15/9 XX ✕
VUL

1st Plt, A Btry Vul Sp, 2d Bn, 15th ADA, 9th Inf Division

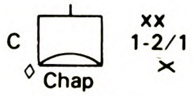

6-8 III ✕ 12/38


Hawk (Imp)

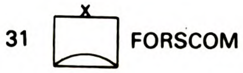
6th Bn Hawk (Imp), 8th ADA, 12th ADA Gp, 38th ADA Bde



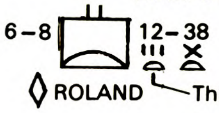
10th ADA Gp, 32d Army Air Defense Command



Btry C, Chap SP, 1st Bn, 2d ADA, 1st Inf Div



31st ADA Bde, US Army Forces Command

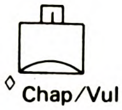


This symbol indicates strictly an ADA command element.

USER NOTE: For other type ADA units delete Hawk, Chaparral, Vulcan, etc.; replace with applicable identifier; e.g., Hercules, Warhead Support, etc.

- **Temporary Grouping of Units**

The symbol ⊓ placed over the size of a unit indicates a temporary grouping of units, usually for a specific tactical operation and in which the shown unit functions as the command or controlling element.



Example:

ADA Composite Battery C/V. This is a temporary mixing of weapons for an air defense in a specific tactical situation.

Reference: FM 21-30

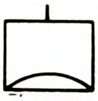
USER NOTE: When the correct symbol is not shown, a symbol may be made up, provided it is explained in a legend added to the map or overlay being drawn.

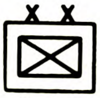
14-2 MAPS AND OVERLAYS

Maps and overlays use military symbols to show plans, orders, and information concerning specific or general military situations. The following methods are those most frequently used in making overlays and situation maps.

- **Colors.**
  - **Blue or Black** . . Friendly units, installations, equipment, and activities.
  - **Red** . . . . Enemy units, installations, equipment and activities.
  - **Yellow** . . . . Friendly or enemy areas of chemical, biological or radiological contamination.
  - **Green** . . . . Friendly or enemy manmade obstacles.

If only one color is available, friendly symbols are outlined with single lines; enemy symbols with double lines.

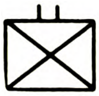

Friendly

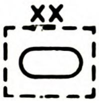

Enemy

Lines and Locations

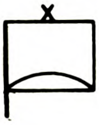
Lines

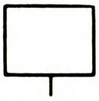
Unit and installation symbols are drawn with either solid or broken lines.


A solid line symbol represents a present or actual location.

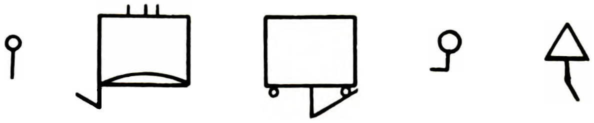

A broken line symbol indicates a future or projected location.

The center of the symbol indicates the general location of the unit or installation. To indicate precise locations, use the following:

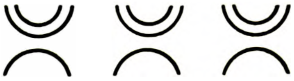

The base of the staff indicates the precise location of the headquarters of an ADA brigade.


A central staff may be used to indicate the precise location of a unit or activity other than the headquarters symbol.

The staff may be extended or bent as required to avoid cluttering symbols. This type of offset is used when units and activities are located close together.



- Front lines are marked by a series of lines which curve away from opposing forces. If one color is used, enemy lines are represented by double lines.

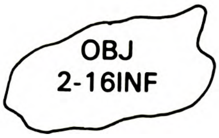


- Control or coordination lines are solid or broken lines usually drawn perpendicular to the direction of advance.

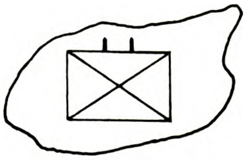
FSCL ———— FSCL	Fire Suport Coordination Line
LD ———— LD	Line of Departure
LD/LC ∩∩∩ LD/LC	Line of Departure is line of contact
PL PL ———— GREEN GREEN	Phase line with code name
NFL - - - - - - - - - NFL	No Fire Line
PLD - - - - - - - - - PLD	Probable Line of Deployment
FCL ———— FCL	Fire Coordination Line

Objectives and Areas

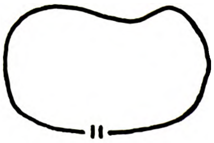
An overlay normally shows objectives for only those units under control of the headquarters issuing the plan or order. Each objective is identified by a solid-line "goose egg", containing the abbreviation "OBJ" and a designator.



Areas are shown as defended or undefended. Undefended areas are enclosed and the unit symbol is placed in the center. Defended areas are shown by the enclosed line broken by the unit size symbol.



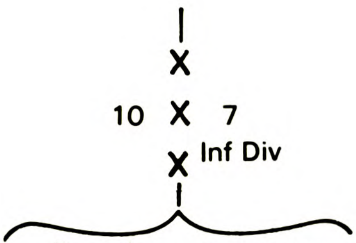
Undefended
(assembly area)



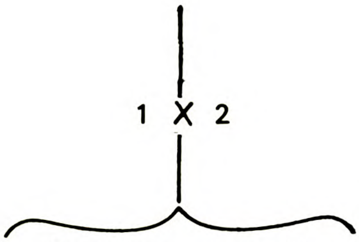
Defended

Boundaries

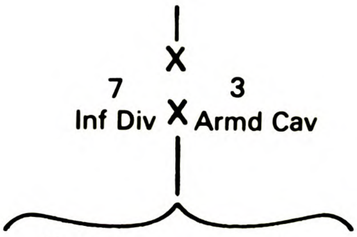
Boundaries are marked by a solid line with the size indication of the unit shown at convenient intervals.



Boundary separates 10th Corps and 7th Inf Div



Boundary separates 1st and 2d Bdes and 7th Inf Div

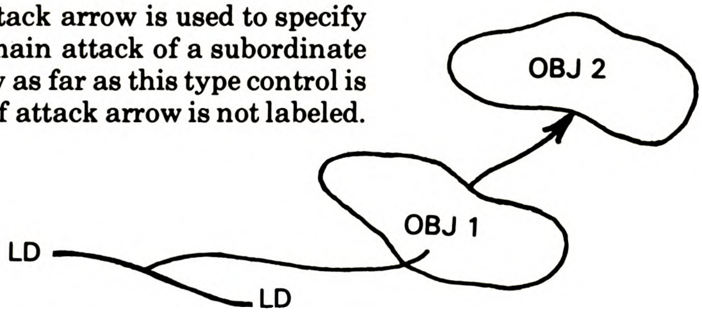


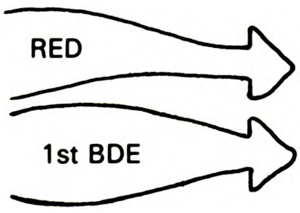
Boundary separates 7th Inf Div and 3d Armd Cav Regt

In the offense, lateral boundaries extend beyond the objective to enable fires and other actions to be coordinated. In the defense lateral boundaries normally extend forward to limit of the commands area of influence. If practicable, boundaries are based on definable terrain features. Rear boundaries are habitually shown for divisions and higher levels. Proposed boundaries are shown by dotted lines.

Direction of Attack, Axis of Advance, and Routes of March

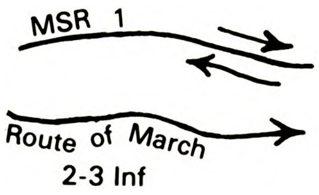
A direction of attack arrow is used to specify the direction of the main attack of a subordinate unit and extends only as far as this type control is needed. A direction of attack arrow is not labeled.





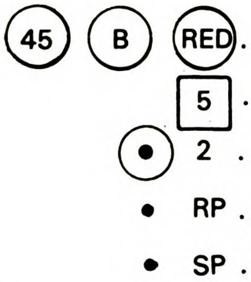
An axis of advance indicates the general direction of advance of a unit. An axis of advance may be identified by a code name or by the designation of the unit that is to use it.

Routes of march are shown by arrows, and are labeled with the word route, their purpose and/or code name or unit designation.



Control Points

Control points are normally drawn on a selected, conspicuous terrain feature and designated with a number, letter or code name.



45 B RED .... Check Point

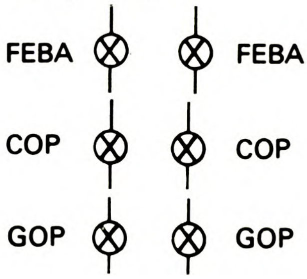
5 .... Contact Point

2 .... Linkup Point

RP .... Release Point

SP .... Start Point

Coordinating Points



FEBA — Forward edge of the battle area

COP — Combat Outpost

GOP — General Outpost

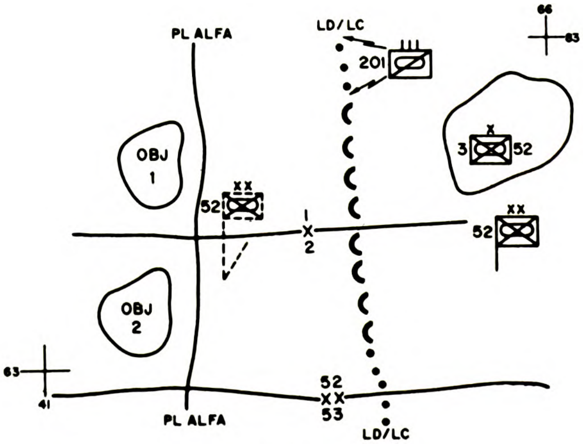
USE OF MILITARY SYMBOLS

This is an example of an annex issued with an operation order.

CLASSIFICATION →

Annex B (OP Overlay) to OPORD 7-52 Mech Div

Reference: Map, series V661, KANSAS-MISSOURI, sheet 7061 (METROPOLIS-JUNCTION CITY), edition 1, 1:50,000.



CLASSIFICATION →

Figure 14-1. ***Operation Overlay to an Operation Order.***

14-3 WORLD GEOGRAPHIC REFERENCE SYSTEM

■ The World Geographic Reference System (GEOREF) is a worldwide position reference system that may be applied to any map or chart graduated in latitude and longitude regardless of projection. GEOREF is used in all joint air defense operations. Air defense artillery units use GEOREF on early warning plotting boards, on radar PPI screens, and for reporting target positions into air defense command and control systems.

■ Geographic Coordinates

Geographic coordinates are reported as longitude and latitude. Longitude coordinates are identified as west or east (W or E) of the prime meridian. Latitude coordinates are identified as north or south (N or S) of the equator.

EXAMPLE

121° 35′ 42″W 102° 21′ 53″E	Longitude Coordinates
51° 18′ 26″N 22° 36′ 49″S	Latitude Coordinates

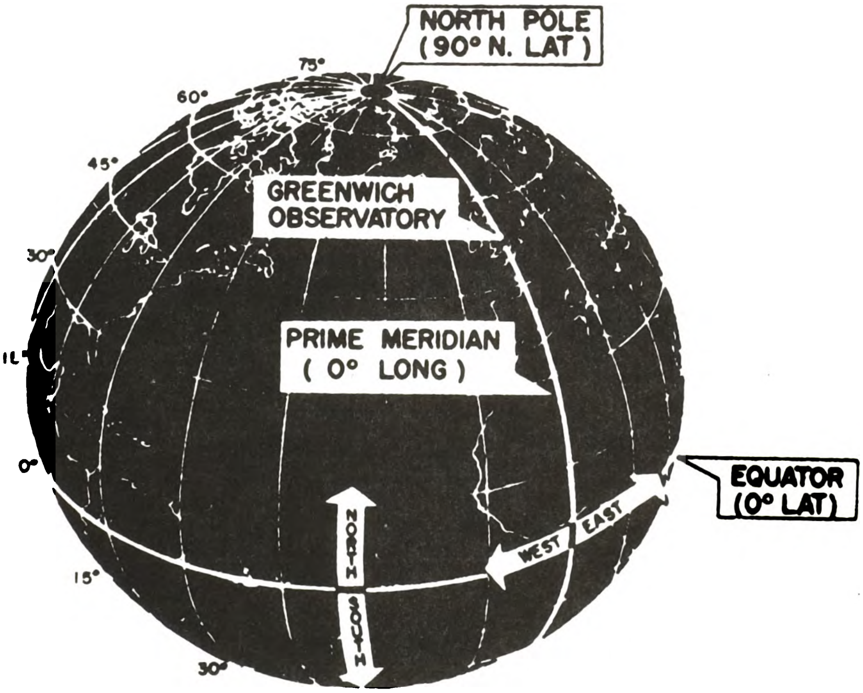


Figure 14-2. Geographic Coordinates.

To locate a point using geographic coordinates requires two sets of characters, longitude and latitude coordinates. GEOREF requires only one set of characters to locate the same point.

EXAMPLE

106° 25′ 48″W 31° 48′ 06″N	Geographic coordinates (El Paso, TX.)

E J P B 3448) - GEOREF (El Paso, TX)

GEOREF coordinates are divided into three divisions called: first, second, and third division GEOREF. The longitude element always comes first.

EXAMPLE

Longitude	Latitude	Longitude	Latitude	Longitude	Latitude
E	J	P	B	34	48
1st Div		2d Div		3d Div	

First Division

The first division of GEOREF divides the surface of the earth into 24 longitudinal zones of 15° each and 12 latitudinal bands of 15° each.

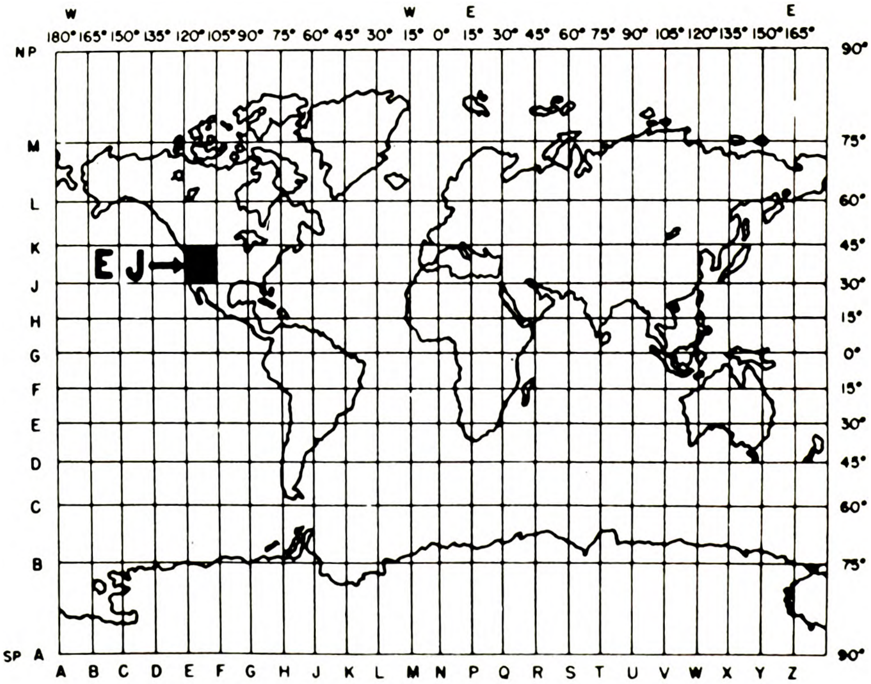


Figure 14-3. ***First Division, 15° Quadrangles.***

Second Division

The 15° quadrangle (first division) designated by the first two letters of the GEOREF code is subdivided into 225 quadrangles formed by 15 longitudinal zones and 15 latitudinal bands each 1° wide.

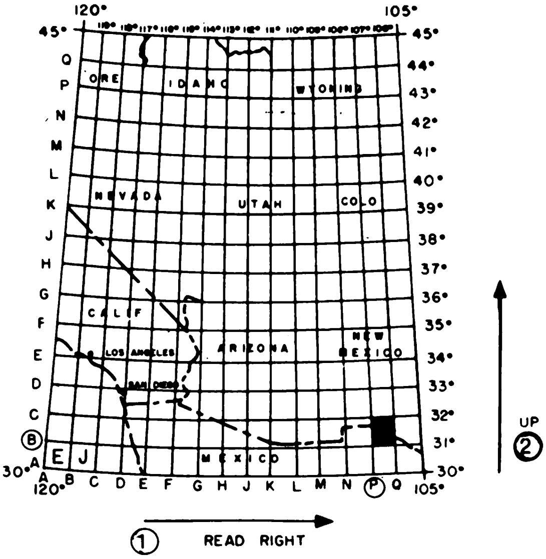


Figure 14-4. Second Division 1° Quadrangles.

Third Division.

The 1°, second division, quadrangle is divided into 60 longitudinal zones of 1′ east and west and 60 latitudinal bands of 1′ north or south to make 3,600 third division (1′) quadrangles.

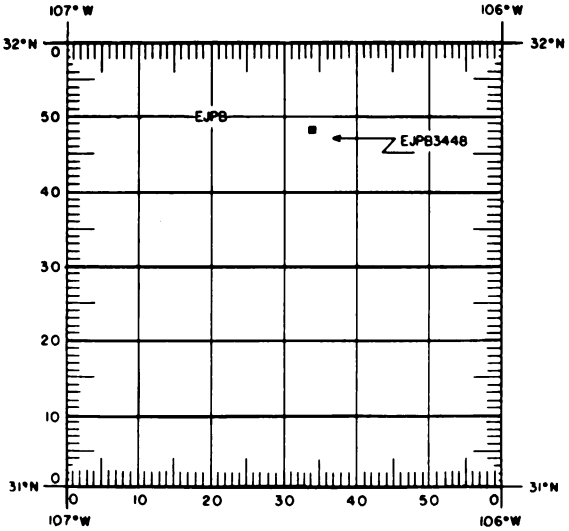


Figure 14-5. Third Division: 1′ Quadrangles.

USER NOTE: GEOREF coordinates are read right-up over the whole earth's surface.

Converting Geographic Coordinates to GEOREF.

A simple way of changing coordinates of longitude and latitude into GEOREF coordinates is by the use of the NEWS (North, East, West, South) rule and the Alpha Numerical relationship table.

EXAMPLE

Information must be obtained from both the longitude and latitude coordinates. Hence the NEWS rule and division must be performed on both sets of coordinates with longitude data always coming first and latitude data coming second in each division.

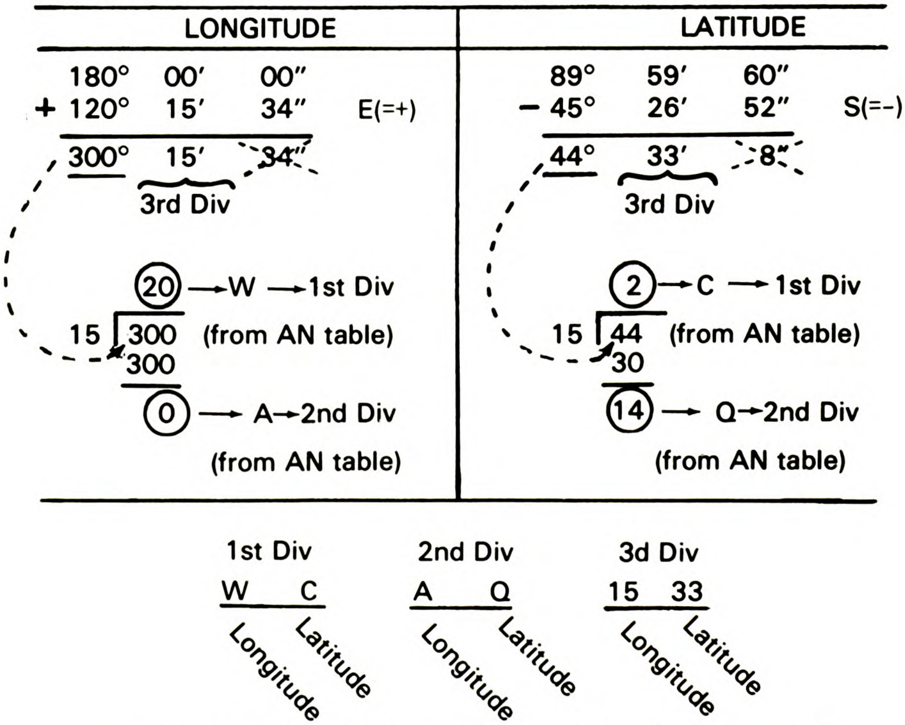
45° 26′ 52″ S → Latitude
120° 15′ 34″ E → Longitude

N	E	W	S
90°	180°	180°	90°
(+)		(−)	

Alpha Numerical Relationship Table (AN).

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	U	V	W	X	Y	Z

COMPUTATION:



The GEOREF Coordinates Are: W C A Q 15 33

USER NOTE: For detailed information on GEOREF, see TC 44-1-4.

◆◆◆

CHAPTER 15 OPERATIONS-COMMAND/STAFF PROCEDURES

15-1 ORGANIZATION FOR AIR DEFENSE

Structure

An air defense force is structured to integrate all available air defense weapon systems, regardless of service, to achieve the maximum protection of the force against attack from the air. Major considerations in the organization for air defense include, but are not limited to the following:

- **Allocation of AD resources required for air defense of the force and priority assets.**
- **Enemy strike capabilities.**
- **A coordinated and joint air defense system responsive to a single air defense commander.**
- **Providing air defense capabilities to the subordinate echelons.**
- **Achieving flexibility through tailoring, to meet tactical and strategic requirements.**

Command Relationships and Responsibilities

The air defense command organization adheres to the principle of unity of effort and responsiveness to a single air defense commander. The four possible command relationships are:

- **Command**

  Command includes the authority and responsibility for effectively using available resources for the accomplishment of assigned missions in accordance with established policies.

- **Operational Command (Operational Control)**

  Operational command provides authority and responsibility for designation of air defense priorities, mission assignment, organization for combat, unit tactical positioning, control of fires, and establishment of air defense rules and procedures; and delegation of authority, all in accordance with established joint policies and procedures.

- **Command Less Operational Control**

  The term denotes "administrative control" and describes authority and responsibility in respect to administrative and logistical matters not included in the operational missions of the subordinate units.

- **Support**

  The commander exercising command or operational control may place ADA units in support of another unit by assigning appropriate tactical missions. The degree of air defense support or reinforcement is determined by the particular tactical mission.

15-2 ADA ORGANIZATION FOR COMBAT

Air defense artillery organizes for combat to deploy the best possible weapon mass and mix to support the scheme of maneuver. The organization for combat includes determining required attachments, supporting roles, designation of tactical missions, and delegation of operational control authority as necessary. The ADA unit plans and operation officer (G3/S3) recommends the organization for combat for ADA units in support of combat operations. Sound organization for combat requires application of basic organizational principles and consideration of various influencing factors.

Principles for Organization for Combat

- **Support the force concept of operation.**
- **Provide for centralized direction and decentralized execution.**
- **Adhere to common doctrine.**
- **Support the committed maneuver elements.**
- **Provide means commensurate with responsibility.**

Factors Influencing Organization for Combat.

- **ADA units available and combat ready.**
- **The air threat.**
- **ADA weapon capabilities and characteristics.**
- **The types of defenses envisioned.**
- **Applicability of the various tactical missions.**
- **The availability of other air defense coverage.**
- **Combat service support capabilities.**
- **Terrain and weather conditions.**
- **Future operations.**

Tactical Missions

Tactical missions for ADA units are assigned by the force commander exercising command or operational control, based on the force ADA commander's recommendations, and published in the force operations order. Tactical missions define the responsibility of ADA placed in support or reinforcement of another unit. The tactical missions are primarily applicable to combat zone ADA operations, but may be used elsewhere. Responsibilities inherent in each of these tactical missions are tabulated in the table below and discussed in the following paragraphs.

General Support (GS)

An ADA unit assigned a GS mission provides air defense for the force as a whole.

- **General Support-Reinforcing (GSR)**

An ADA unit given a mission of GSR furnishes ADA support to the force as a whole and, further, augments the fires of another ADA unit.

- **Reinforcing (R)**

An ADA unit assigned the mission of reinforcing augments the fires of another ADA unit.

- **Direct Support (DS)**

An ADA unit with a direct support mission provides close and continuous air defense support to a designated maneuver unit and coordinates its movement and fires with the element it supports. The DS mission is appropriate for a battery or battalion.

- **Modified Tactical Missions**

Whenever the intent of the commander cannot be conveyed by the use of a standard tactical mission, a standard mission may be modified or amplified by appropriate instructions. In the modification of a standard tactical mission, care must be taken not to degrade the ability of the unit to accomplish the explicit air defense responsibilities of that standard tactical mission. The direct support tactical mission normally should not be modified. It is common to amplify the general support tactical mission.

Table 15-1. ADA Tactical Mission/Responsibilities

An ADA unit with a Tactical Mission of---	Responds to AD Rqmts directly from---	Establishes Liaison and Communication with--	Priorities for AD Established by---	Is Positioned by---
General Support	Force ADA commander	As required	Force commander	Force ADA commander
General Support-Reinforcing	Force ADA commander and reinforced unit commander	Reinforced ADA unit	1. Force commander 2. Reinforced ADA unit commander	Force ADA commander
Reinforcing	Reinforced ADA unit commander and Force ADA commander	Reinforced ADA unit	1. Reinforced ADA unit commander 2. Force commander for priorities outside the reinforced unit's zone/sector	Reinforced ADA unit commander
Direct Support	Supported unit commander and Force ADA commander	Supported unit	1. Supported unit commander 2. Force commander for priorities outside the supported unit's zone/sector	ADA unit commander

15-3 CONTROL OF ADA FIRES

Rules and procedures for control of ADA fires are established by the area and regional air defense commanders and published in theater directives, operation orders, and the tactical SOP of each unit having an air defense mission or capability.

Conditions of Readiness

Conditions of readiness are the means used to maintain friendly forces at a state of preparedness compatible with the evaluation of the threat. The term defense readiness condition (DEFCON) is used in relation to the conditions of readiness and the Army air defense commander prescribes a required state of alert for ADA units compatible with the DEFCON.

Air Defense Warnings

Air defense warnings are informational in nature and state the likelihood of enemy air attack based on intelligence. Air defense warnings are:

RED.* *Attack imminent or in progress.

YELLOW.* *Attack probable.

WHITE.* *Attack not probable.

Weapons Alert Designators (WAD)

WAD are control measures that provide an expeditious means of specifying the minimum states of alert required of ADA units within a particular defense.

Table 15-2. WAD States of Alert ADA Units

AD Warnings	Codewords	12 Hr	3 Hr	1 Hr	15 Min	5 Min	Battle Stations
White	A	25%	25%	25%	25%		
	B		50%	25%	25%		
	C		25%	50%	25%		
Yellow	D			25%	50%	25%	
	E				50%	50%	
Red	F						100%

(% of weapons at each state of alert)

The force ADA officer recommends alert status requirements for inclusion in the air defense SOP.

Rules of Engagement

The air defense rules of engagement are directives that describe the circumstances under which weapons can fire at an aircraft. Key elements of air defense rules of engagement are:

- **Designation of persons authorized to declare an aircraft hostile.**
- **Criteria by which an aircraft may be declared hostile.**
- **Definition of conditions under which an aircraft may or must be engaged.**
- **Preservation of the right of self defense.**

Rules of engagement are included in the tactical SOP of each unit having an air defense mission or capability.

Hostile Criteria

The theater rules of engagement will refer to or include criteria by which an aircraft may be identified and designated as hostile or friend. The means used to identify aircraft as meeting hostile criteria may be electronic or visual, or a combination thereof.

Weapons Control

The area or region AD commander imposes varying degrees of control on all air defense weapons within the theater of operations. If the local situation demands it, unit commander's may impose more restrictive control on assigned, attached, or organic ADA weapons. Weapons control is normally described as a status. Terms commonly used are:

- **WEAPONS FREE** - Weapons may fire at any aircraft ***not positively identified as friendly***. This is the least restrictive of the weapons control.
- **WEAPONS TIGHT** - Fire ONLY at aircraft ***positively identified as hostile*** according to the prevailing hostile criteria.
- **WEAPONS HOLD** - *Do not fire except* in self defense.

Firing Commands

Firing commands commonly used in the control of ADA weapons include:

- ***HOLD FIRE***, if the weapons system has the capability, is used to protect specific friendly aircraft. Fire is withheld and, any missiles in flight are immediately destroyed.

- ***CEASE FIRE*** is used to preclude simultaneous engagement of a target by both interceptor aircraft and ADA weapons. Fire is withheld but tracking continues. Any missiles already in flight are permitted to continue toward intercept.

- ***CEASE ENGAGEMENT*** is used to alert a unit to prepare to engage a higher priority target. If rounds are not already in flight, the engagement sequence is stopped and the unit prepares to engage a new target. If missiles are already launched, they are permitted to intercept the target.

Nuclear Weapon Control

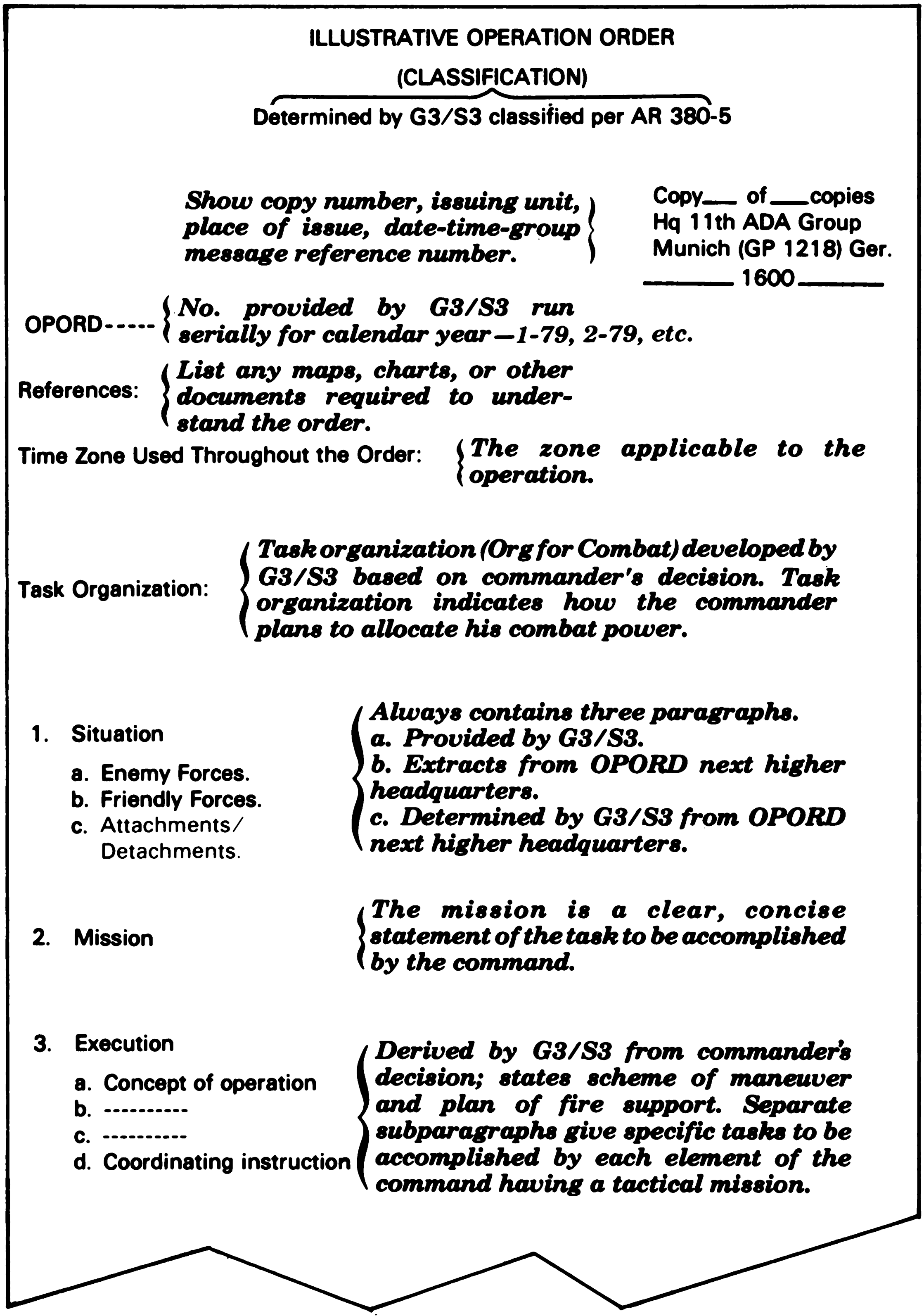
Allocation of available nuclear weapons to air defense commanders is entirely within the authority and control of the unified command. The actual expenditure of allocated AD nuclear weapons is not authorized until released by a predesignated authority. Weapons control cases, warhead selection, and other classified procedures governing nuclear weapon employment are contained in (C) FM 44-1B.

15-4 ORDERS

Orders are of two general classes - combat and routine. Combat orders pertain to strategic or tactical operations and their attendant combat service support. Routine orders cover normal administrative operations in garrison or field.

Combat Orders - Operation Orders

The purpose of an operation order is to give subordinate commanders the information necessary to carry out an operation.



ILLUSTRATIVE OPERATION ORDER

(CLASSIFICATION)

Determined by G3/S3 classified per AR 380-5

Show copy number, issuing unit, place of issue, date-time-group message reference number.

Copy___ of ___copies
Hq 11th ADA Group
Munich (GP 1218) Ger.
______ 1600 ______

OPORD----- *No. provided by G3/S3 run serially for calendar year—1-79, 2-79, etc.*

References: *List any maps, charts, or other documents required to understand the order.*

Time Zone Used Throughout the Order: *The zone applicable to the operation.*

Task Organization: *Task organization (Org for Combat) developed by G3/S3 based on commander's decision. Task organization indicates how the commander plans to allocate his combat power.*

1. Situation
   a. Enemy Forces.
   b. Friendly Forces.
   c. Attachments/Detachments.

Always contains three paragraphs.
a. Provided by G3/S3.
b. Extracts from OPORD next higher headquarters.
c. Determined by G3/S3 from OPORD next higher headquarters.

2. Mission

The mission is a clear, concise statement of the task to be accomplished by the command.

3. Execution
   a. Concept of operation
   b. ----------
   c. ----------
   d. Coordinating instruction

Derived by G3/S3 from commander's decision; states scheme of maneuver and plan of fire support. Separate subparagraphs give specific tasks to be accomplished by each element of the command having a tactical mission.

4. Service Support
   a. General
   b. Materiel and Services
   c. Civil-Military operations

Provided by G4/S4 in coordination with G1/S1, G5, and support command commander and appropriate special staff officers. If instructions are numerous/voluminous, they may be included in an annex and reference made to them in para 4. Annex designations are provided by G3/S3.

5. Command and Signal

Contains command and signal instructions. As a minimum, makes reference to the CEOI annex.

Acknowledge.

Directs recipient of the order to acknowledge receipt. Acknowledgement may be in the clear using message reference number.

SMITH
COL

The commander or his designated representative signs the orginal. If signature is not reproducible, the G3/S3 authenticates subsequent copies.

Smith
SMITH
Col

OFFICIAL:
Jones
JONES
GS/SE

For the Commander
Jones
JONES
S3

Annexes:
A/H

Annexes are lettered alphabetically and are listed in the order in which they appear in the OPORD. G3/S3 designates letter to be associated with a given annex. Annexes are prepared by the staff officer having subject matter responsibility.

Distribution: A

Distribution formula is included in SOP. G3/S3 establishes distribution.

Figure 15-1. Illustrative Operation Order.

Air Defense Annex to OPORD

The air defense annex to an operation plan/order is prepared by the force air defense officer and his staff. As a general rule the annex will follow the five-paragraph format presented for the operation order; however, it may be in the form of an overlay, sketch or plan. The heading, acknowledgement, command line, and authentication are required when the annex is issued by separate distribution or given wider distribution than the OPORD.

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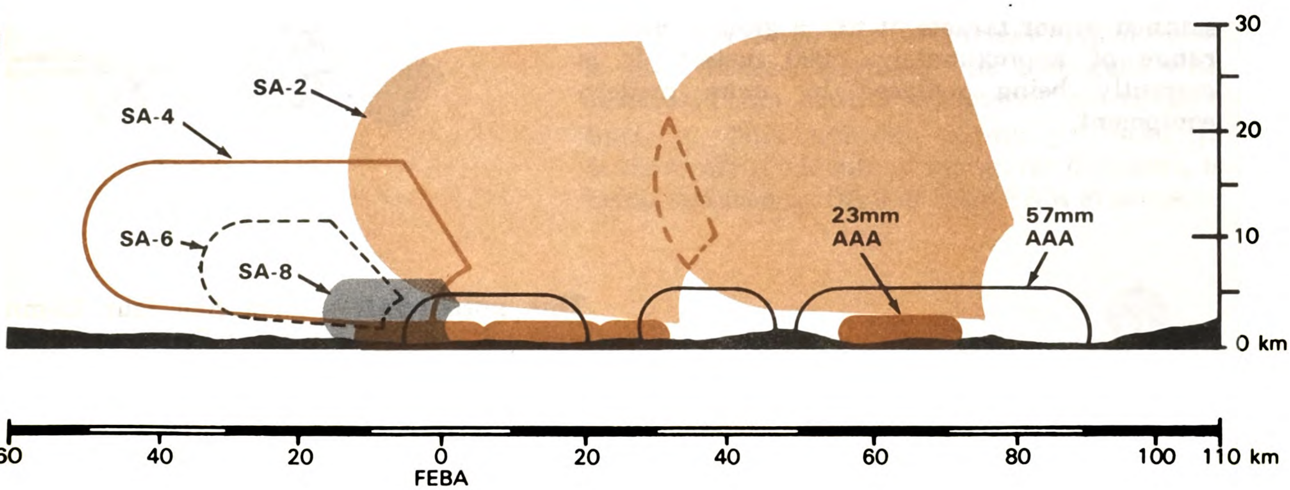
CHAPTER 16 SOVIET AIR DEFENSE WEAPONS

16-1 GENERAL

Soviet forces have developed and deployed a great number of mobile surface-to-air missiles and conventional air defense guns for air defense of their field units. This mix of guns and missiles provides a mobile umbrella which accompanies each echelon of Soviet armies, including forward deployed battalions. As new air defense systems are introduced into the Soviet forces, the older systems are still retained in the active weapon inventory. Soviet air defense weapons include:

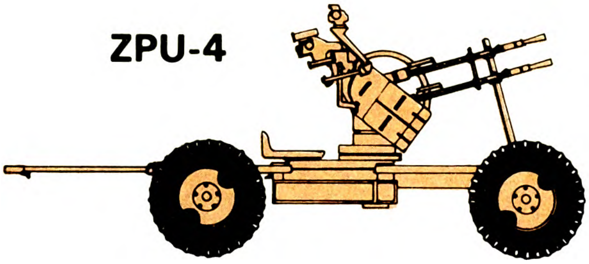
SOVIET ARMY AIR DEFENSE ENVELOPE *



*Does not include air defense weapons of maneuver regiments and lower echelons.

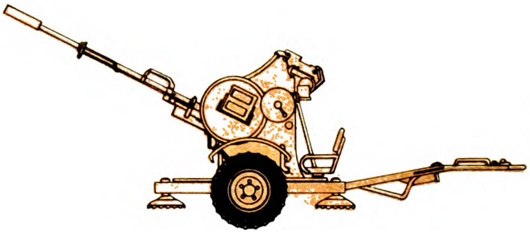
Figure 16-1. Type Army Air Defense Envelope.

ZPU-4



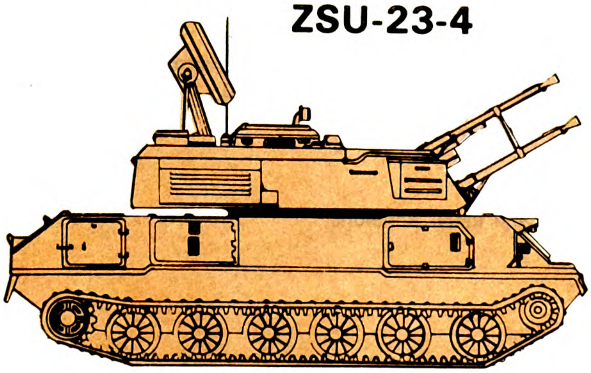
This antiaircraft (AA) weapon has four 14.5-mm heavy machineguns with a combined cyclic rate of fire of 2,200 to 2,400 rounds per minute. It traverses 360° and with its optical fire control has a tactical AA range of 1,400 meters. It is currently being replaced by more modern equipment.

ZU-23



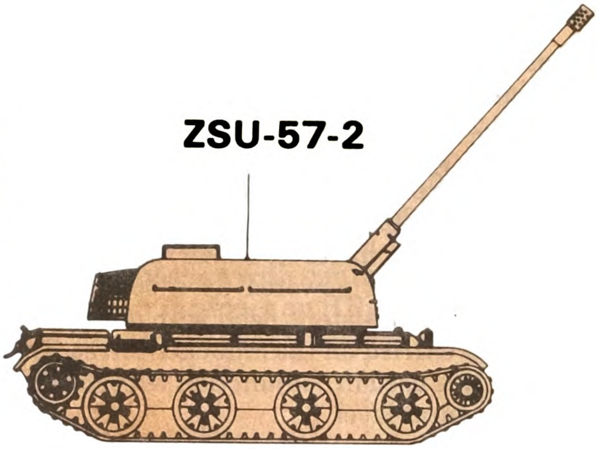
This antiaircraft system consists of two 23-mm cannons, which in the cyclic mode fires a maximum of 2,000 rounds per minute. The ZU-23 traverses 360° and with its optical fire control has a tactical AA range of 2,500 meters. Against thin-skinned armor targets, it has a ground combat range of approximately 1,000 meters. It is currently being replaced by more modern equipment.

ZSU-23-4



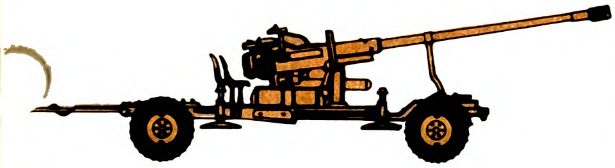
This antiaircraft system has four 23-mm cannons with a cyclic rate of fire up to 4,000 rounds per minute; the maximum practical rate of fire is 2,000 rounds per minute. It traverses 360° and, with the gun dish radar, has a tactical antiaircraft range of 3,000 meters. Using optical sights, tactical antiaircraft range is 2,500 meters. The ZSU-23-4 is effective up to approximately 1,000 meters against thin-skinned ground targets. The ZSU-23-4 is mounted on a modified PT-76 armored vehicle chassis, carries a four-man crew, and can fire on the move at speeds up to 25 kph. The ZSU-23-4 can be used in conjunction with the SA-9 GASKIN. It is found in tank and motorized rifle regiments of tank and motorized rifle divisions. It is integrated into the attack formations.

ZSU-57-2



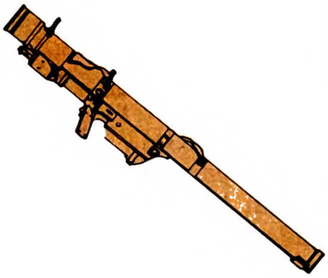
This AA system has two 57-mm cannons with a combined rate of fire of 210 to 240 rounds per minute. It traverses 360° and has a tactical range of 4,000 meters. The ZSU-57-2 is mounted on a modified T-54 tank chassis and carries a 5-man crew. Fire control is optically directed. The ZSU-57-2 is presently being replaced by more modern equipment. When still found in maneuver units, it is normally located with tank regiments.

S-60



This antiaircraft system has one 57-mm cannon with a cyclic rate of fire of 105 to 120 rounds per minute. It traverses 360° and, when directed by the off-carriage FLAP WHEEL radar, has a tactical AA range of 6,000 meters. The tactical AA range with on-carriage optical sights is 4,000 meters. Normally, six S-60 guns with associated fire control equipment constitute a battery. This system normally found in antiaircraft regiments of maneuver divisions, is being replaced by SA-6 or SA-8 SAM systems.

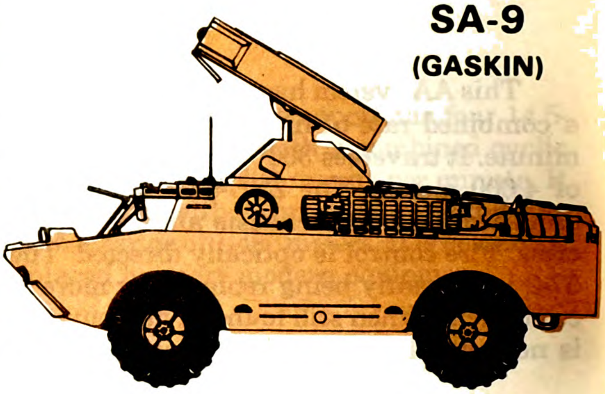
SA-7
(GRAIL)



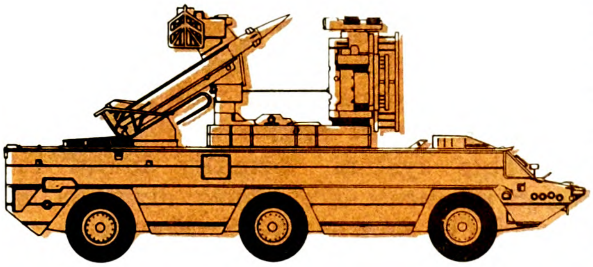
This man-portable air defense (MANPAD) missile system is 1.2 meters long. The missile, which is fired from a shoulder launcher, has passive infrared homing guidance and an HE warhead. A solid fuel booster and sustainer propel the GRAIL to a maximum slant range of approximately 3.5 kilometers. It can be fired from the ground or a vehicle and may be used against aircraft flying at altitudes from approximately 50 to 3,500 meters. Nine SA-7 GRAIL launchers are found in each tank and motorized rifle battalion and are further assigned in groups of three to company level.

This short-range air defense (SHORAD) system has been recently introduced into the Threat inventory. It is transported on a modified BRDM-2 amphibious armored vehicle which carries a probable crew of four. The SA-9 has a slant range of approximately 5 kilometers and an altitude capability of about 5,000 meters. The missile has an infrared seeker, an HE warhead, and probably is powered by a solid propellant. Four missile canisters, each with one missile, are normally carried on the launcher turret. The SA-9 GASKIN is used in conjunction with the ZSU-23-4 at regimental level.

SA-9
(GASKIN)



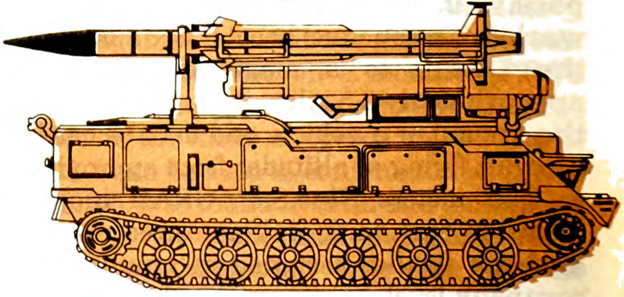
SA-8
(GECKO)



The SA-8 SHORAD missile operates by command guidance and is effective at altitudes from 50 to 6,500 meters. It is fully self-contained with acquisition, tracking, and two missile guidance radars mounted on a six-wheeled, amphibious vehicle. Four missiles are carried in an integrated mount. The system contains an electro-optical tracker, probably television. With a slant range of approximately 10-15 kilometers, the highly mobile SA-8 can provide close support to armored and mechanized forces. The SA-8 is a new weapon system now being introduced into the Threat inventory.

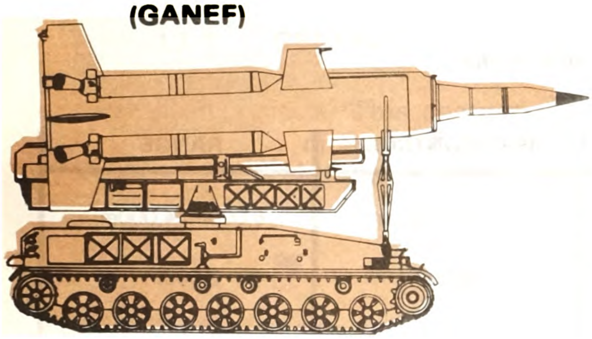
SA-6
(GAINFUL)

This air defense missile has a slant range of about 30 kilometers. It is powered by an integral solid rocket/ramjet system and is command guided by the STRAIGHT FLUSH fire control radar. The missile carries an HE fragmentation warhead and can be employed against aircraft flying at altitudes from about 100 to 11,000 meters. This system was used effectively during the 1973 Middle East War. It may be assigned at Army and division levels.



SA-4

(GANEF)

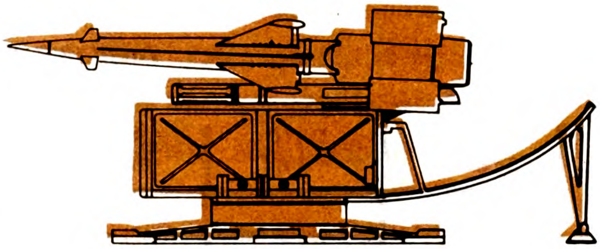


This air defense missile has a slant range of approximately 70 kilometers. The GANEF has command guidance to a maximum altitude of about 27,000 meters. The missile is powered by four solid fuel boosters with canted nozzles and a ramjet sustainer. It carries an HE proximity-fuzed warhead. The SA-4 system may be assigned at Front or Army level.

SA-3

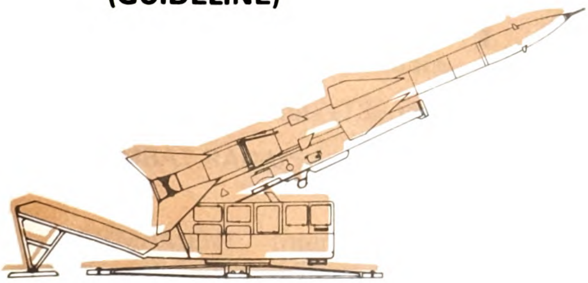
(GOA)

This air defense missile probably is command guided. The missile has an effective range of about 24 kilometers. Powered by a two-stage solid fuel booster and a solid fuel sustainer, the missile can carry its HE proximity-fuzed warhead to altitudes in excess of 13,000 meters. This system is assigned at Front or Army level.



SA-2

(GUIDELINE)



This high-to-medium altitude air defense (HIMAD) missile has a slant range of approximately 40 kilometers. It has two stages, a solid fuel booster and a liquid fuel rocket sustainer that boosts its 130 kilogram HE warhead to a maximum altitude of about 27,000 meters. The typical SA-2 site consists of six launchers arranged in a star-like configuration around the FAN SONG radar guidance equipment. The SA-2 system is assigned at Front or Army level.

Table 16-1. Soviet Gun Systems.

SYSTEM	NO. & TYPE GUN	RPM	FIRE CONTROL	RANGE
S-60	1/57mm	120	Radar/Optical	6,000m/4,000m
ZU-23	2/23mm	2,000	Optical	2,500m
ZPU-4	4/14.5mm	2,400	Optical	1,400m
ZSU-23-4	4/23mm	4,000	Radar/Optical	3,000m/2,500m
ZSU-57-2	2/57mm	240	Optical	4,000m

Table 16-2. Soviet Missile Systems.

SYSTEM	NATO NAME	SLANT RANGE	ALTITUDE	WARHEAD	GUIDANCE
SA-2	GUIDELINE	45km	27,000m	HE	Radar
SA-3	GOA	24km	13,000m	HE	Command
SA-4	GANEF	70km	27,000m	HE	Command
SA-6	GAINFUL	37km	100-11,000m	HE	Command
SA-7	GRAIL	3.5km	50-3,500m	HE	Infrared Homing
SA-8	GECKO	10-15km	50-6,500m	HE	Radar/Electro-optical
SA-9	GASKIN	5km	5,000m	HE	Infrared Homing

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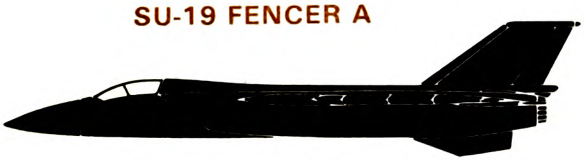
CHAPTER 17 SOVIET AIRCRAFT

17-1 GENERAL

This chapter contains illustrations and brief descriptions of Soviet aircraft. The information is general in nature and, if more detailed information is required, classified threat documents should be consulted.

- **Multirole Attack Aircraft.**

SU-19 FENCER A



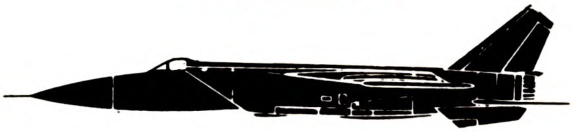
TYPE: Heavy Fighter/Light Bomber

SPEED: ?

COMBAT RADIUS: 125-250 miles (200-400 km)

ARMAMENT: Externally carried warloads of approximately 5 tons. Includes bombs, 57-mm unguided rockets, or four air-to-surface missiles.

MIG-25 FOXBAT



TYPE: Reconnaissance/Fighter

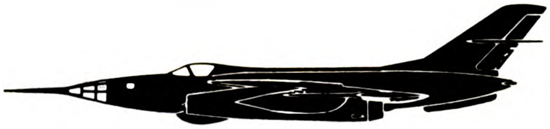
SPEED: 1,835 knots (2,115 mph)

COMBAT RADIUS: 700 miles (800 km)

ARMAMENT: Four hardpoints.

Note: Capable of attacking opportunity targets.

YAK-28P BREWER



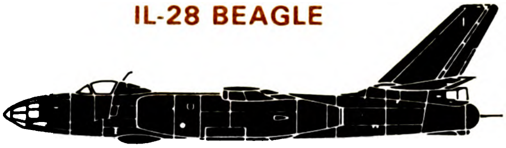
TYPE: Tactical Strike/Attack

SPEED: 636 knots (733 mph)

COMBAT RADIUS: 1,200-1,600 miles (1,930-2,575 km)

ARMAMENT: Internal bomb bay; 30-mm cannon.

IL-28 BEAGLE



TYPE: Tactical Bomber/Reconnaissance

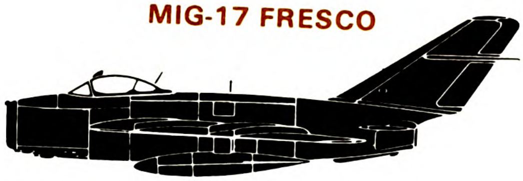
SPEED: 485 knots (559 mph)

COMBAT RADIUS: 1,400 miles (2,260 km)

ARMAMENT: Four automatic cannon; 2-20-mm, 2-23-mm. Bomb load; 4,500 lb.

■ Forward Area Aircraft.

MIG-17 FRESCO



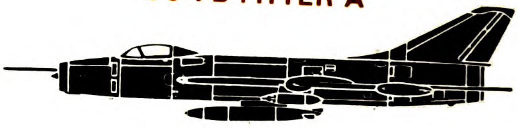
TYPE: Ground Attack Fighter (secondary role)

SPEED: 600-700 knots (711 mph)

COMBAT RADIUS: 200-300 miles (320-480 km)

ARMAMENT: One 37-mm, two 23-mm cannon, rocket pods or bombs

SU-7B FITTER A



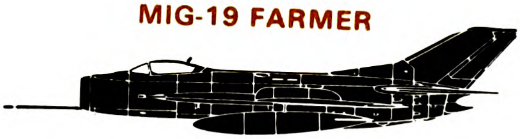
TYPE: Ground Attack Fighter

SPEED: 1,040 knots (1,196 mph)

COMBAT RADIUS: 200-300 miles (320-480 km)

ARMAMENT: Rocket packs and bombs; usually two 1,650 lb and two 1,100 lb; 30-mm cannon.

MIG-19 FARMER



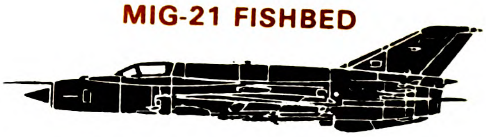
TYPE: Ground Attack Fighter (secondary role)

SPEED: 783 knots (902 mph)

COMBAT RADIUS: 425 miles (685 km)

ARMAMENT: Rocket packs and bombs, drop tanks, etc. Three 30-mm cannon.

MIG-21 FISHBED



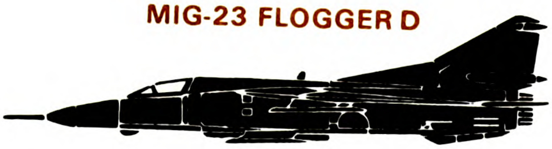
TYPE: Ground Attack Fighter (secondary role)

SPEED: 1,203 knots (1,385 mph)

COMBAT RADIUS: 683 miles (1,100 km)

ARMAMENT: Underwing pylons for weapons or drop tanks; rocket packs, etc.; twin barrel 23-mm cannon.

MIG-23 FLOGGER D



TYPE: Ground Attack Fighter (secondary role)

SPEED: 1,233 knots (1,420 mph)

COMBAT RADIUS: 600 miles (960 km)

ARMAMENT: Bombs; CBU's; one 23-mm twin cannon rack.

SU-17/20 FITTER C

TYPE: Ground Attack Fighter

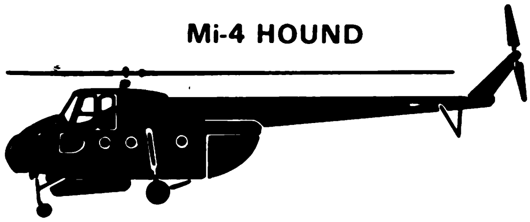
SPEED: 1,040 knots (1,196 mph)

COMBAT RADIUS: 200-300 miles (320-480 km)

ARMAMENT: Rocket packs and bombs cannon.

■ Threat Helicopters.

Mi-4 HOUND



TYPE: Transport and General Utility

SPEED: 113 knots (130 mph)

ARMAMENT: Close support version has machinegun and air-to-surface rockets.

Note: 1. Carry 12-18 men
2. Airborne cavalry or assault or commando raid.

Mi-8 HIP

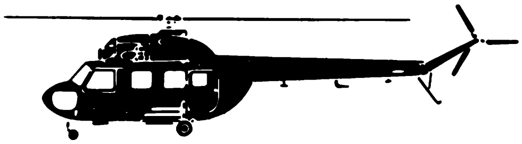
TYPE: Medium Transport and Assault Helicopter

SPEED: 135 knots (155 mph)

ARMAMENT: Can be equipped with external stores.

Note: 1. Carry 12-24 men
2. Airborne cavalry assault or commando raid.

Mi-2 HOPLITE



TYPE: Utility

SPEED: 113 knots (130 mph)

Note: 1. Carry 6-8 men
2. Commando raid.

Mi-6 HOOK

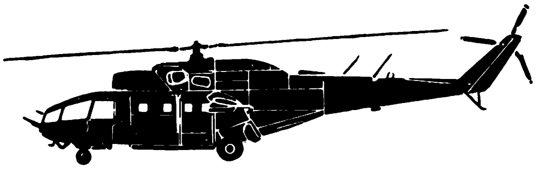
TYPE: Heavy Transport and Assault Helicopter

SPEED: 162 knots (186 mph)

ARMAMENT: Some fitted with gun in nose.

Note: 1. Carry 60-80 men
2. Airborne cavalry assault or commando raid.

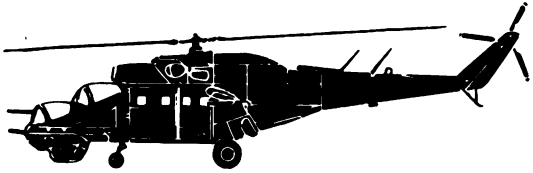
Mi-24 HIND A



TYPE: Assault/Attack Helicopter

SPEED: 145 knots (165 mph)

Mi-24 HIND D



ARMAMENT: Three weapon stations on wings; antiarmor missiles and rocket pods, a four-barrel 12.7-mm Gutling-type nose machinegun.

Threat Bombers.

TU-16 BADGER

TYPE: Medium Bomber, Reconnaissance Bomber

SPEED: 510 knots (587 mpm)

COMBAT RADIUS: 3,000 miles (4,800 km)

ARMAMENT: Four 23-mm cannon; bomb load of up to 19,800 lb.

Air to surface missiles.

TU-22 BLINDER

TYPE: Interdiction, Armed Reconnaissance

SPEED: 800 knots (920 mph)

COMBAT RADIUS: 1,400 miles (2,250 km)

ARMAMENT: BLINDER A: Has fuselage bay for free fall bombs.
BLINDER B: Air-to-surface missile; one 30-mm cannon.

TU-95 BEAR

TYPE: Turbo-Prop, Long-Range Bomber
Secondary role — ECM
SPEED: 434 knots, (500 mph)

COMBAT RADIUS: 7,800 miles (12,555 km)

ARMAMENT: Three pairs of 23-mm cannon, up to 25,000 lb of bombs.
Air to surface missiles.

Threat Reconnaissance/observation Aircraft.

MIG-21 FISHBED H

TYPE: Tactical Reconnaissance

SPEED: 1,200 knots (1,383 mph)

COMBAT RADIUS: 683 miles (1,100 km)

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CHAPTER 18 AERIAL TARGETS FOR TRAINING

Normally, all ADA live firing evaluations are conducted using high-performance unmanned aerial targets suitably equipped and capable of simulating combat target characteristics which will require the ADA weapon system to use its maximum capability. Numerous types of aerial targets, operated by troop units or furnished and operated by contract personnel, are available for ADA service practice.

RCAT MQM-33 (OQ-19), Light Target Missile (Creeper)

The MQM-33 is a high-wing monoplane controlled remotely by radio and powered by a four-cylinder, two-cycle, air-cooled engine. The target system is used for training, and evaluation of the following systems: Vulcan, M42 (Duster), automatic weapons, and small arms. Stocks of this target are low and the system will phase out when stocks are exhausted.

Data Summary

Launch	Ground launched by jet assisted takeoff (JATO) zero-length launcher.
Power plant	72 hp, four-cylinder air-cooled engine.
Guidance	Auto pilot and command guidance.
Recoverability	Recoverable by parachute.
Performance	Maximum speed - 206 knots. Altitude - up to 23,000 ft. Endurance - maximum 68 minutes.

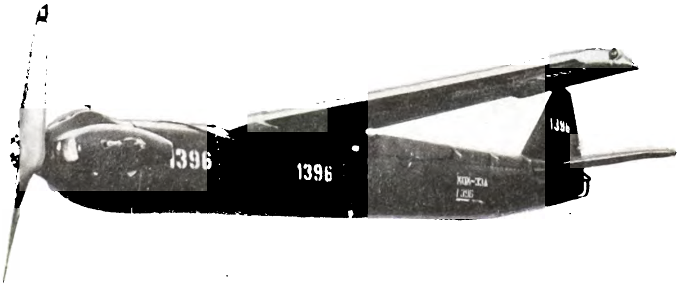

Figure 18-1. RCAT MQM-33 (OQ-19).

■ MQM-34D (Firebee)

The MQM-34D is a mid-wing, high-speed, remotely controlled target missile. The target is propelled by a single turbojet engine. During flight the target can execute all normal flight maneuvers, and is recovered by a parachute recovery system. The mission of the MQM-34D is to support training and evaluation of air defense artillery personnel.

Data Summary

Launch	Ground launched from zero-length launcher using JATO.
Power plant	Turbojet engine with 1,700 lb maximum thrust.
Guidance	Command guidance.
Recoverability	Recoverable by parachute.
Performance	Speed: 500 knots. Altitude: 100 to 61,000 ft. Endurance: 90 minutes.

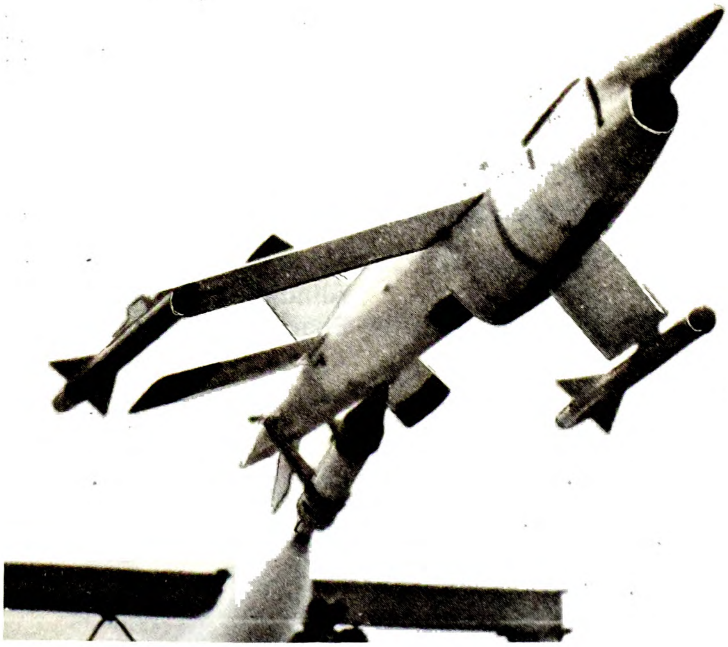

Figure 18-2. MQM-34D Firebee.

Ballistic Aerial Target System (BATS)

The BATS is a low-cost, one-flight, expendable target for ADA training and service practice. It is completely troop operated. BATS is used in support of Vulcan, Chaparral, and Redeye training.

Data Summary

Launch	Ground launched from three-point slide with 0-45° launching elevation.
Power plant	Two to five 2.75-inch rocket motors; two jet engine starter cartridges as sustainers.
Guidance	None (ballistic aimed).
Recoverability	Nonrecoverable.
Performance	Speed: 275-550 knots. Altitude: 8,000 ft maximum. Endurance: 47 seconds.

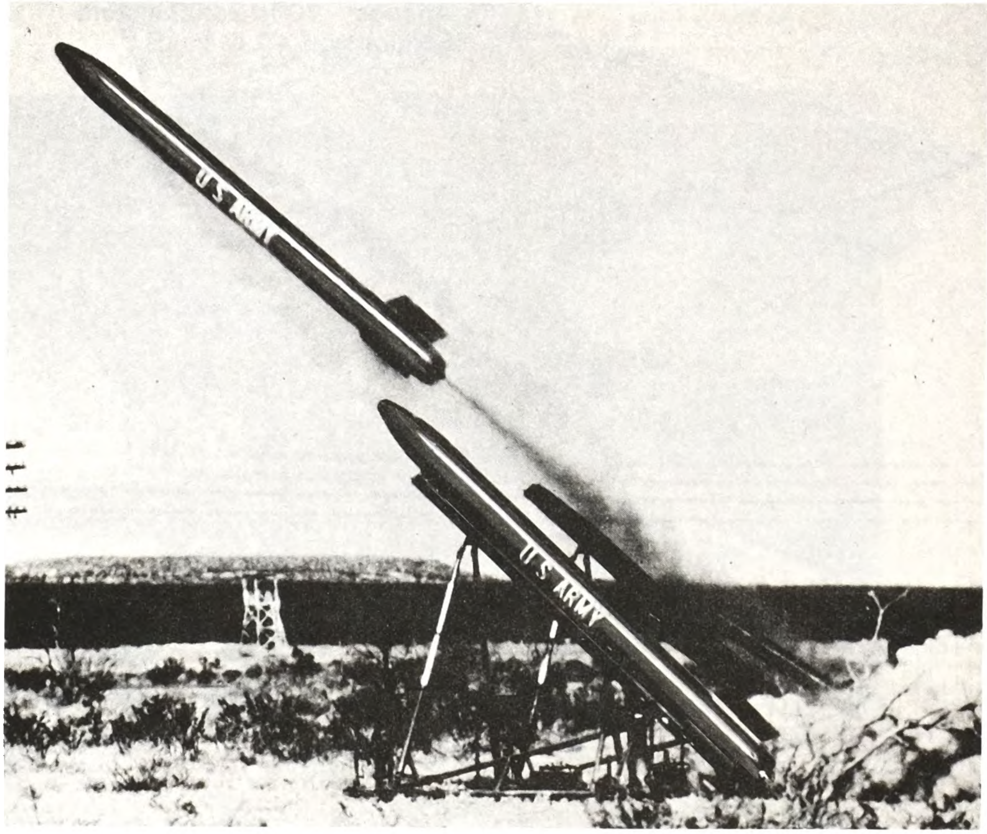

Figure 18-3. BATS on Launcher.

Variable Speed Training Target (VSTT) (MQM-107) (Streaker)

The VSTT provides the altitude, speed, and maneuver capability required for supporting annual service practice (ASP) for Hawk units. The air transportable feature allows for maximum target support to Hawk units deployed worldwide.

The Streaker can be fitted with devices which provide simulated radar and infrared signatures of actual aircraft and missiles.

Data Summary

Launch	Ground launch by zero-length launcher.
Power plant	Turbojet.
Guidance	Digital command-telemetry readouts.
Recoverability	By parachute.
Performance	Speed: 250-500 knots. Altitude: 100-12,200 meters. Endurance: 47 seconds.

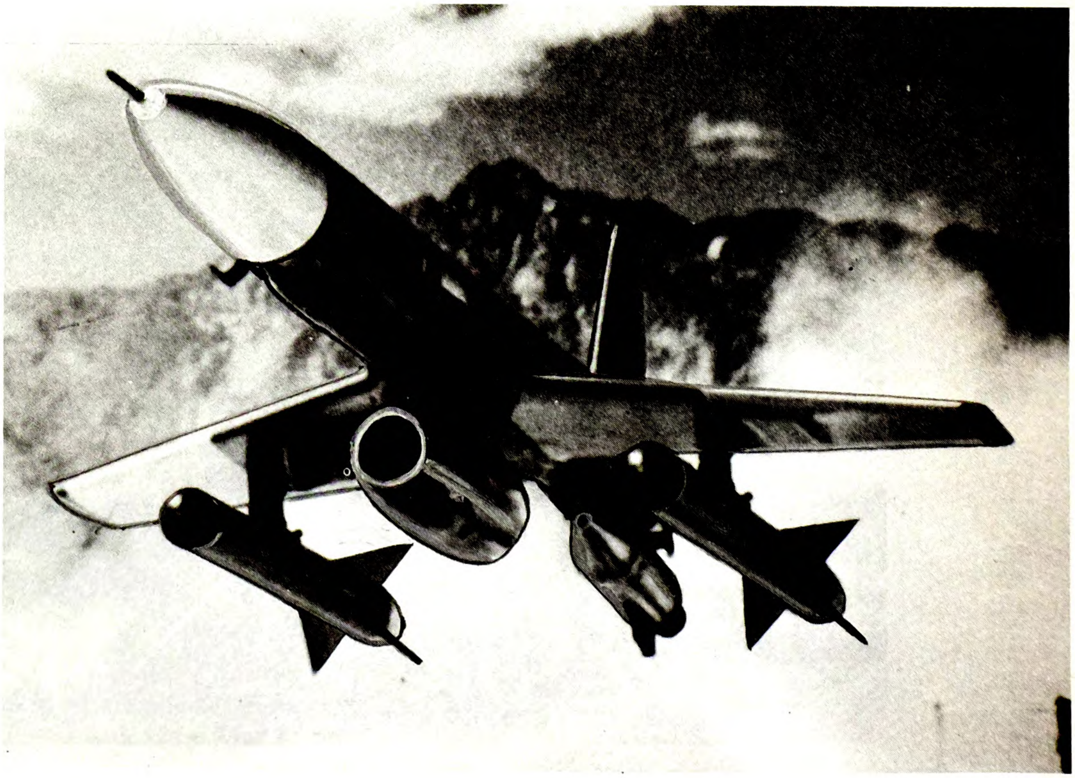

Figure 18-4. Variable Speed Training Target (VSTT) (MQM—107) (Streaker).

Radio-Controlled Miniature Aerial Target (RCMAT)

The RCMAT can be used to provide aerial target tracking training for Chaparral, Redeye, and Vulcan gunners and live fire targets for M42 gunners and small arms air defense training. The RCMAT has not been standardized and its procurement has been through commercial sources with local training funds. A program to standardize RCMAT targets has been initiated and pending the adoption of a standard model the US Army Training Support Agency (TSA) is producing styrofoam delta wing models known as the Fort Lewis Model. By flying the RCMAT at varying ranges the gunners are presented with a wide variety of target sizes and speeds. At close ranges the RCMAT can exceed the tracking rate of both Chaparral and Vulcan.

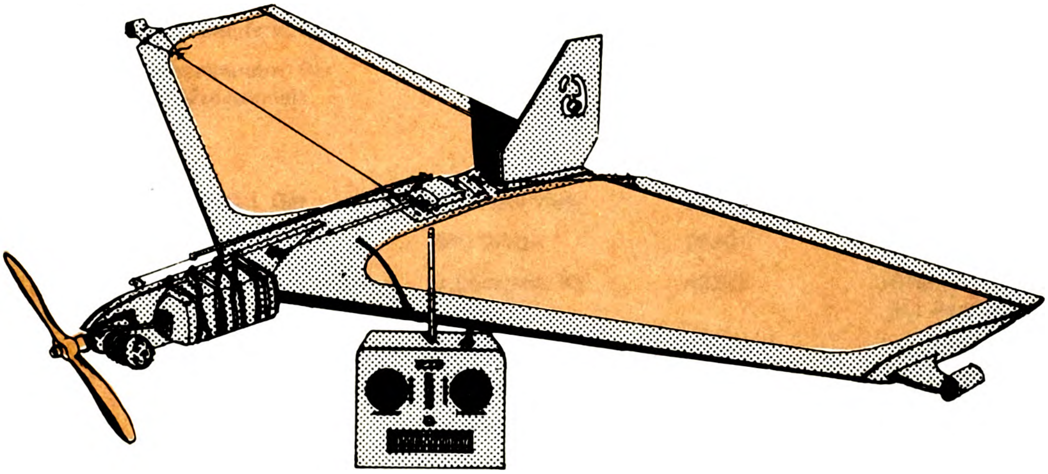

Figure 18-5. Radio-Controlled Miniature Aerial Target (RCMAT).

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APPENDIX A ADA UNITS

ORGANIZATION	LOCATION	P.O. ADDRESS	ZIP CODE	PARENT ORGANIZATION
32d AADCOM	Darmstadt, Ger	APO New York	09175	Hq USAREUR
31st Brigade	Homestead AFB	Homestead AFB, FL	33030	FORSCOM
38th Brigade	Osan, Korea	APO SF CA	96570	8th US Army
10th ADA Group	Darmstadt, Ger	APO New York	09175	32d AADCOM
11th ADA Group	Ft Bliss	Ft Bliss, TX	79916	USAADCENFB
69th ADA Group	Wurzsburg, Ger	APO New York	09801	32d AADCOM
94th ADA Group	Kaiserslautern, Ger	APO New York	09227	32d AADCOM
108th ADA Group	Kaiserslautern, Ger (Provisional)	APO New York	09227	32d AADCOM
BATTALIONS				
1st Bn 1st ADA Hawk	Wildflecken, Ger	APO New York	09026	10th ADA Group
1st Bn 2d ADA Hawk	Sihing-Ni, Korea	APO SF CA	96301	38th Brigade
1st Bn 3d ADA Vul (T) (Air Assault)	Ft Campbell	Ft Campbell, KY	42223	101st Airborne (Air Assault)
1st Bn 7th ADA Hawk	Ft Bliss	Ft Bliss, TX	79916	11th ADA Group
1st Bn 43d ADA Herc	Ft Richardson	APO Seattle	99505	FORSCOM
1st Bn 44th ADA Hawk	Kwang Chun, Korea	APO SF CA	96307	38th Brigade
1st Bn 51st ADA C/V	Ft Ord	Ft Ord, CA	93941	7th Inf Div
1st Bn 55th ADA C/V	Ft Bliss	Ft Bliss, TX	79916	5th Inf Div
1st Bn 59th ADA C/V	Wackernheim, Ger	APO New York	09185	8th Inf Div
1st Bn 62d ADA C/V	Hawaii	APO SF CA	96225	25th Inf Div
1st Bn 65th ADA Hawk	Key West	Key West, FL	33040	31st Brigade
1st Bn 67th ADA C/V	Ft Lewis	Ft Lewis, WA	98433	9th Inf Div
1st Bn 68th ADA C/V	Ft Hood	Ft Hood, TX	76544	1st Cav Div
2d Bn 1st ADA Herc	Wackernheim, Ger	APO New York	09185	94th ADA Group
2d Bn 2d ADA Hawk	Giessen, Ger	APO New York	09169	10th ADA Group
2d Bn 5th ADA C/V	Ft Hood	Ft Hood, TX	76544	2d Armored Div
2d Bn 52d ADA Herc	Homestead AFB	Homestead AFB,FL	30330	31st Brigade
2d Bn 55th ADA Hawk	Ft Bliss	Ft Bliss, TX	79916	11th ADA Group
2d Bn 56th ADA Herc	Pirmasens, Ger	APO New York	09189	94th ADA Group
2d Bn 57th ADA Hawk	Ansbach, Ger	APO New York	09177	69th ADA Group
2d Bn 59th ADA C/V	Schwabach, Ger	APO New York	09142	1st Armored Div

2d Bn 60th ADA C/V	Ramstein, Ger	APO New York	09012	32d AADCOM
2d Bn 61st ADA C/V	Changhi-RI, Korea (Camp Mosier)	APO SF CA	96224	2d Inf Div
2d Bn 62d ADA Hawk	Spangdahlem, Ger	APO New York	09123	10th ADA Group
2d Bn 67th ADA C/V	Kaiserslautern, Ger	APO New York	09029	32d AADCOM
2d Bn 71st ADA Hawk	Uijongbu, Korea (Camp Redcloud)	APO SF CA	96358	38th Brigade
3d Bn 4th ADA V(T)	Ft Bragg	Ft Bragg, NC	28307	82d Airborne
3d Bn 7th ADA Hawk	Schweinfurt, Ger	APO New York	09707	69th ADA Group
3d Bn 59th ADA Hawk	Hanau, Ger	APO New York	09165	10th ADA Group
3d Bn 60th ADA Hawk	Grafenwoehr, Ger	APO New York	09114	69th ADA Group
3d Bn 61st ADA C/V	Budingen, Ger	APO New York	09076	3rd Armored Div
3d Bn 67th ADA C/V	Giebelstadt, Ger	APO New York	09036	3d Inf Div
3d Bn 68th ADA Hawk	Homestead AFB	Homestead AFB, FL	33039	31st Brigade
3d Bn 71st ADA Herc	Kornwestheim, Ger	APO New York	09154	94th ADA Group
4th Bn 1st ADA C/V	Ft Bliss	Ft Bliss, TX	79916	11th ADA Group
4th Bn 61st ADA C/V	Ft Carson	Ft Carson, CO	80913	4th Inf Div
4th Bn 62d ADA Herc	Ft Bliss	Ft Bliss, TX	79916	USAADCENFB
5th Bn 6th ADA Herc	Hoppstadten, Ger	APO New York	09034	94th ADA Group
5th Bn 52d ADA C/V	Ft Stewart	Ft Stewart, GA	31313	24th Inf Div
5th Bn 57th ADA Hawk	Ft Bliss	Ft Bliss, TX	79916	USAADCENFB
6th Bn 52d ADA Hawk	Wuerzburg, Ger	APO New York	09801	69th ADA Group
6th Bn 56th ADA C/V	Spangdahlem, Ger	APO New York	09123	32d AADCOM

UNITED STATES ARMY NATIONAL GUARD AIR DEFENSE ARTILLERY UNITS

111th ADA Brigade NMARNG	Box 11396 Station E	Albuquerque, NM	87112
107th ADA Group VAARNG	P.O. Box 255	Sandston, VA	23150

BATTALIONS

3d Bn 111th ADA AW SP	P.O. Box 3295 Olive Station	Portsmouth, VA	23701
2d Bn 263d ADA AW SP	P.O. Box 713	Anderson, SC	29621
1st Bn 265th ADA SP FLANG	Lake Ave & Park Place	West Palm Beach, FL	33402
2d Bn 174th AW SP OHARNG	Court & Carpenter Streets	Athens, OH	45701
3d Bn 200th ADA AW SP NMARNG	Box 11396 Station E	Albuquerque, NM	87112
4th Bn 200th ADA AW SP NMARNG	900 East Laughlin Ave	Tucumcari, NM	88401
2d Bn 200th ADA AW SP NMARNG	Box 817	Las Cruces, NM	88061
1st Bn 200th ADA AW SP NMARNG	Box 1995	Roswell, NM	88201

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30 JUNE 1978

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